A window open on the world

The UNESCO Courier

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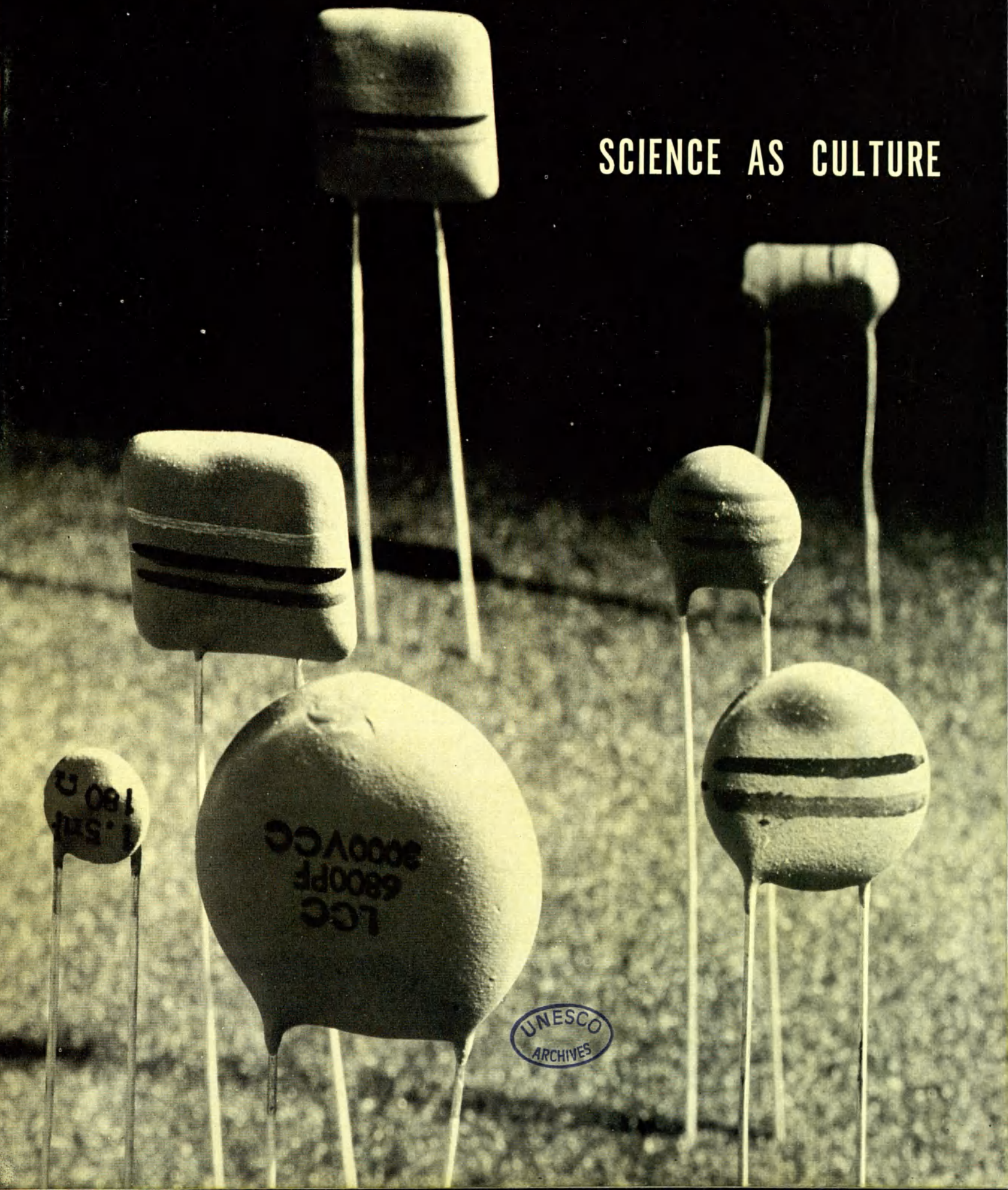

SCIENCE AS CULTURE

UNESCO ARCHIVES

Photo © Rapho-Louis Frédéric

Celestial musician

This flute-playing bronze "Bodhisattva", or future Buddha, was sculptured in the eighth century A.D. on the face of a votive lantern which stands in the avenue leading to the great Todaiji Temple in Nara, Japan. The ancient city of Nara, 220 miles southwest of Tokyo was an outstanding centre of Japanese art. The period of 80 years from when the capital of Japan was established in Nara in 710 A.D. until its transfer to Kyoto in 794, is known as the Golden Age of Japanese sculpture.

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Page

4 SCIENCE AND THE CULTURE OF OUR TIMES
By Laurence M. Gould

11 LILACS IN THE COSMOS...
By Lev Kassil

15 SCIENCE AND FUNDAMENTAL CONCEPTS OF THINKING
By Paul Couderc

17 UNESCO CREATES MATHEMATICAL MODEL TO HARNESS THE MEKONG
By W.J. Ellis

24 THE NEW MUSIC OF THE SPHERES
Communication satellites
By Wilbur Schramm

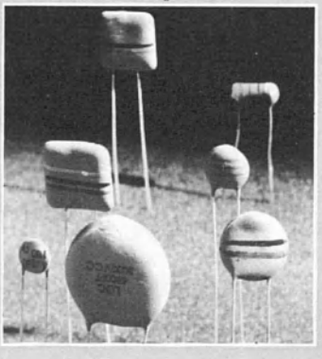
30 THE WORLD WE HOPE FOR
A prize-winning essay from Uruguay
By María Cristina Costa Díaz

33 LETTERS TO THE EDITOR

34 FROM THE UNESCO NEWSROOM

2 TREASURES OF WORLD ART
Celestial musician (Japan)

Photo CSF - Georges Bru



Cover photo

Formerly, science and culture were indistinguishable. Today they appear to be regaining their basic unity. Both are engaged in a pursuit of wisdom that transcends the gap, even the feud, that has developed between them (see articles pp. 4 and 11). Photo shows tiny condensers—a basic tool of modern science—that until recently were used in the manufacture of all electronic apparatus. With increasing miniaturization they are being superseded by much smaller components.

SCIENCE AND THE CULTURE OF OUR TIMES

by Laurence M. Gould

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WHILE modern society seems confident that science and technology can take care of all human needs, I still think not enough people appreciate the magnitude and the violence of the scientific technological revolution in which we are involved. Today, there is no other influence comparable with science in changing the foundations, indeed, the very character of our lives.

Science and its products determine our economy, dominate our industry, affect our health and welfare, alter our relations to all other nations, and determine the conditions of war and peace. Everyone who breathes is affected, and cannot remain impervious to them.

Our very existence is so completely dependent upon science and technology that it would be impossible to materially alter our present methods. We have no option. We can't stifle man's curiosity. It is only from the knowledge that we gain by asking questions, no matter how terrible, how dreadful they are; it is only by these questions that man achieves final dignity.

When I was president of the American Association for the Advancement of Science, I attended the British Association meetings. I was dumbfounded and delighted to hear J.C. Dancy, the great classical scholar, headmaster of Marlborough College, argue "technology and a liberal education, far from being antithetical, are not even complementary; some experience in technology is an essential ingredient in a liberal education."

The Greeks did not scorn technology. Classical Greek civilization was characterized by a unity between art, science, and technology; a unity which is the hallmark of all great civilizations; a unity which disappeared then until Leonardo da Vinci. A historian of science might say that the schism we now know began then, and yet philosophy and science were indistinguishable until almost the end of the 18th century. You can date with exactness when the split came: when philosopher Immanuel Kant said that science dealt only with the world of appearance, and philosophy with the world of reality. Nonsense!

Nevertheless, a dangerous gap has developed. It was greatly overstated by C.P. Snow. I do not subscribe to the idea of two cultures. The gap exists, but the feud between science and the humanities is without substance. It is time it be ended. We must have humanists who comprehend and include scientific and technological knowledge in their dreams of the world, else we shall have no world at all. We must recover the Renaissance. The pursuit of wisdom must at long last be a single enterprise, or liberal education has no meaning.

I studied geology, therefore, I'm a scientist and not a humanist? Somebody studies philosophy or art and, therefore, is a humanist? Nonsense! It isn't true at all. To major in philosophy does not make you a humanist. Don't you remember the greatest of all teachers once said, "Not all who cry Lord, Lord, shall enter the Kingdom of Heaven"? A chemist with an omnivorous intellectual appetite may be a greater humanist than a philosopher whose interest is confined to existentialism.

Part of the problem is semantics. Certain words lose their meaning. I think humanism has. It implies that all else may be something less than human. I was delighted when Joseph Wood Krutch wrote in a "Saturday Review" article, "the trouble is that 'humanities', narrowly interpreted, ceases to mean much more than the polite accomplishment analogous to the needlework and flower painting which ladies were once supposed to dabble in, primarily to demonstrate that they were ladies rather than something economically and socially inferior."

Let me state a little more seriously: a great disservice has been done to the truly humanistic tradition by trying to identify it too closely with particular fields of study. Many supposed conflicts rise from a gross misunderstanding of what science is all about.

Science is not a form of black magic. A thousand blind alleys must often be explored before a right road is found; a thousand amateurs must have their fling before a Darwin or an Einstein comes along.

Whenever you hear a scientist say, "This is the end of it; this is all of it", that man is no longer a scientist. There is no quest for truth in scientific research which does not carry within itself the possibility, even the probability, of error. We respect the findings of science because they are always open to re-examination and to question. Scientific truth is dynamic and self-correcting and never final.

When someone asked Einstein how he discovered the theory of relativity, he replied, "By challenging an axiom." There never was a great scientist who

CONTINUED ON PAGE 6

LAURENCE M. GOULD *is former president of the American Association for the Advancement of Science. He is now chairman of the Committee on Polar Research, U.S. Academy of Sciences, and has taken part in several expeditions to the Arctic and Antarctic. He has written extensively on Antarctica, the International Geophysical Year and international science. Readers will recall his article, "Antarctica, International Land of Science" which appeared in the January 1962 issue of the "Unesco Courier".*

Though science has long been changing the very nature of human life, surprisingly little place is given to the great discoveries of science in many history books. Certain do not even mention such famous names as Galileo, Kepler, Descartes and Newton. Photo recalls one of Galileo's studies on the laws of bodies in motion —his demonstration that bodies of different weights fall with equal velocities, said to have been carried out in 1589 from the Leaning Tower of Pisa (in background).

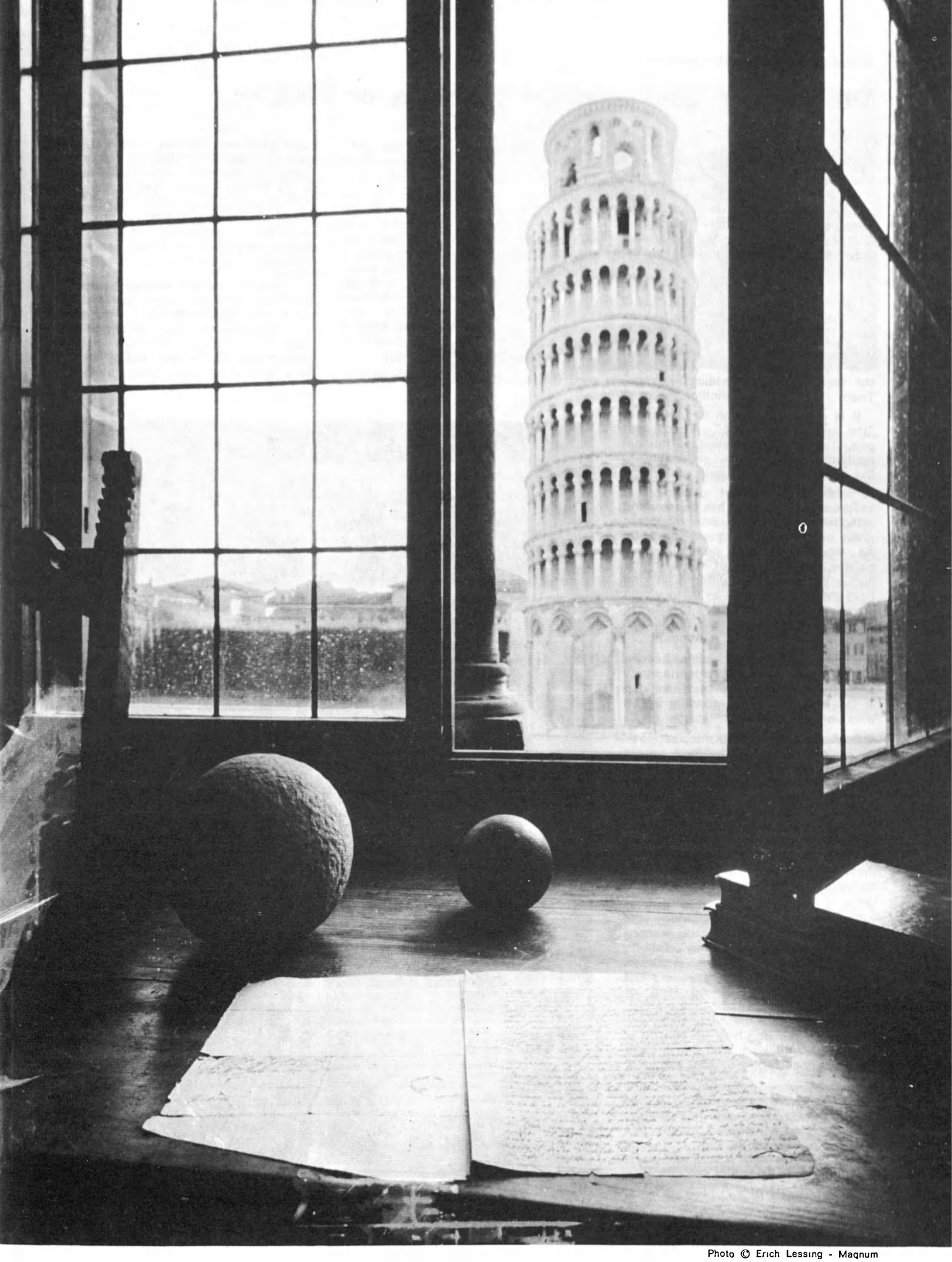


Photo © Erich Lessing - Magnum

Why not an epic poem on Relativity or DNA?

did not make bold guesses, and never one whose guesses were always right. The scientist looks for order. He believes in a real world and he believes that science is a means of teaching the truths about that world. But still, he's got to make guesses. He must invent concepts to make the world intelligible.

So the scientific world never reflects completely the real world, but only selected characteristics organized on accepted assumptions.

The best definition of science is one by George Boas: "Science is the art of understanding nature." There is no better definition.

It is oversimplification to talk about "*the* scientific method." There isn't one. There are a thousand, all rational methods. But human rationality is the most important realm in which man can fruitfully live.

To me, pure science has been, along with religion and art, one of man's great avenues in his quest for truth. As Jacob Bronowski points out, "I believe the concepts of value in the humanities are not as different in kind from those of sciences as many would have us believe. Both seek to express the deep relations between the human mind and the world it matches."

Coleridge, trying to define beauty, always returned to: "Beauty is unity and variety." Well, reverse it—science is the search to discover unity in the wild variety of nature.

Both the scientist and the poet seek to explore and to understand. It is only the form of exploration which is different. You cannot enter any world of meaning without making postulates. In religion we call them faith; in ethics we call them norms or ideals; in science we call them hypotheses or theories; the choice of these hypotheses or theories or assumptions is always a matter of faith.

There is a fallacious idea that science is objective while the humanistic studies are subjective. This is complete nonsense. Science is always the record of someone's personal experience. There is no kind of experience that can be impersonal. No one can have the same experiences I have had; the best he can do is have the same kind, and in no case has science reduced the personal equation to zero. Science is subjective within man's nature in the same sense that the other humanistic studies are.

If what I say is true, why has not science played a larger role in liberal education? And though science is so all-pervasive, why have scientists not become a part of the ordinary citizen's experience of knowledge. More strangely, poets and playwrights have not drawn heavily upon science and technology. Twentieth century art and letters do not have great expressions concerning the industrial revolution and its science and technology.

Shelly, in his defence of poetry, said that one of the tasks of the literary artist is to "Absorb the knowledge of the sciences and assimilate it to human needs; colour it with human passions, transform it with the blood and bone of human nature." In other words, literature ought to concern itself with the whole of life, including science.

Dante and Milton especially among Renaissance writers were inspired by astronomy and dealt with it in their own sublime language. When Milton was fascinated by the new optical instruments of Galileo, and when he was portraying his Satan tempting

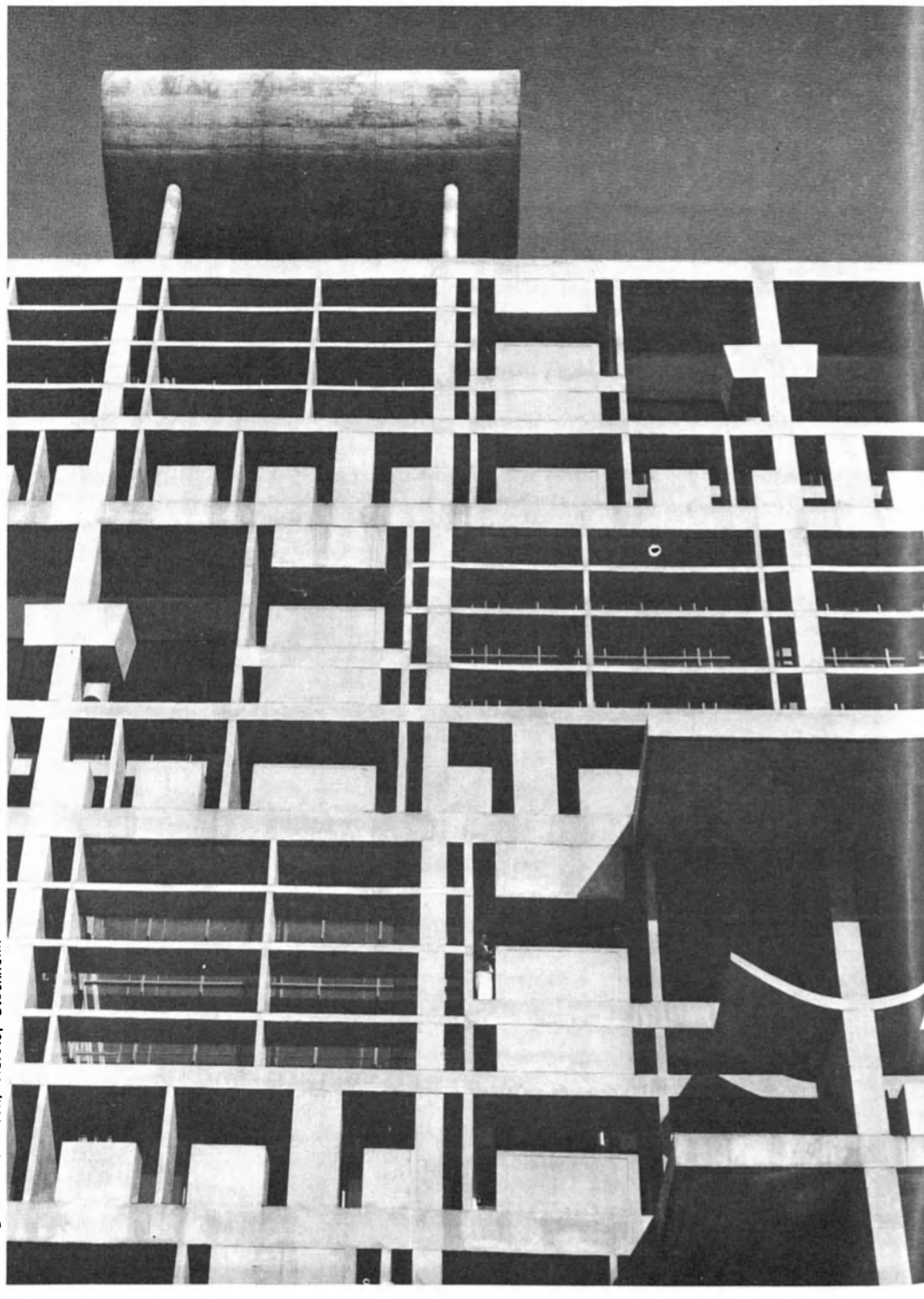
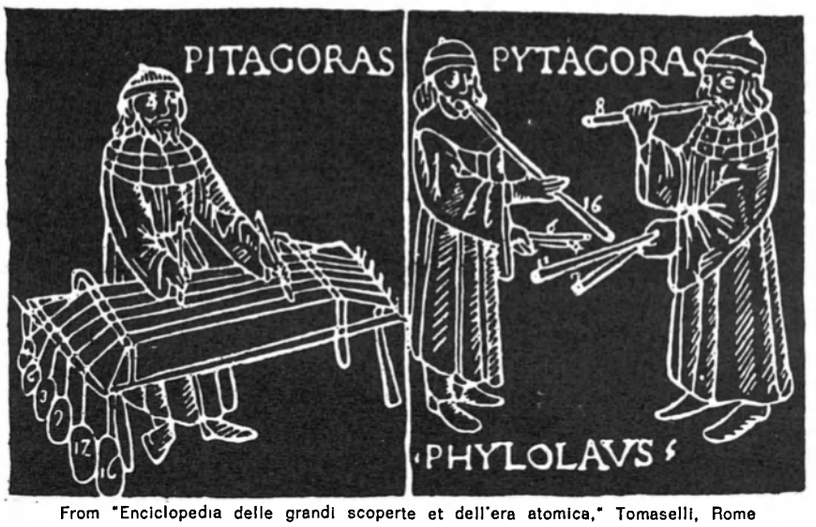


Photo © Lennart Olson, Tiofoto, Stockholm

Building has always drawn on technological innovations, and architecture is as much a science as an art. From the use of concrete, steel and glass have come new concepts of building design and construction. Right, a building in Chandigharh, capital of Panjab (India), built to the plans of Le Corbusier.

In the 5th century B.C., Pythagorus, the great philosopher and mathematician, demonstrated the interrelation of music and mathematics, that music was "the numeral thing par excellence", as the French musicologist Louis Laloy has put it, and that musical intervals are determined by whole numbers. Pythagorus showed that from a string and the note it produces, all the notes of the scale may be obtained by lengthening the string according to given ratios. In ancient times the Chinese too perceived the correlation of music with mathematics. Right, illustrations from a famous work, "The Theory of Music" (1480), by the Italian composer Franchino Gafori, show Pythagorus demonstrating the mathematical essence of music with the aid of a series of strings (on left) and with tubes of different lengths filled with air.



From "Enciclopedia delle grandi scoperte et dell'era atomica," Tomaselli, Rome

Christ, he displays to Him the Kingdom of this world not in antique fashion through the naked eye, but by "optic skill of vision multiplied by air or glass of telescope."

In "Paradise Lost", Milton wrote about Antarctica: "Beyond this flood a frozen continent lies dark and wild, beat with perpetual storms, of whirlwinds and dire hail, which on firm land thaws not but gathers heap, and ruin seems of ancient pile; all else deep snow and ice." No one is writing like that about Antarctica today. Yet science has given some of the greatest epic themes in the history of mankind—the nuclear atom, the chromosomes, and DNA, more beautiful than anything man has contrived.

Oh, I wish Milton could have orbited the earth with John Glenn or Gordon Cooper! It should have been.

The general theory of relativity by which Einstein renounced absolute space and time gave us a picture of unity and harmony surpassing any that man had ever dreamed before. It's probably the finest intellectual achievement of our times, and yet the only poem that I've ever been able to find about relativity is this:

There was a young lady
[named Bright
Who learned to move faster
[than light
She set out one day in a
[relative way
And came back on the pre-
[vious night.

That isn't enough!

We need more scientists who are literate and articulate, but we need more imaginative literature to interpret our mechanized existence into noble language to reach and inspire us. In Shelley's words—"which will transform it with the blood and bone of human nature."

How shall we do that? In medieval universities, philosophy gave unity to the whole. We still have that notion preserved in the fossilized expression, Ph.D., Doctor of Philosophy. You know very well one can have his degree in economics, animal husbandry, or even geology without ever having been exposed to philosophy. There is no unifying study in our culture today.

But let me suggest that history, broadly conceived, could provide the cultural bridge to bring the disciplines of our academic world into order. This idea was said more eloquently by William James: "You can give humanistic value to almost anything by teaching it historically—geology, economics, mechanics are humanities when taught with reference to the achievements of the geniuses to which these sciences owe their being. Not taught thus, literature remains grammar; art a catalogue; history a list of dates; and natural science a sheet of formulas, weights and measures. The sifting of human creations is what we ought to mean by the humanities."

What James is saying is that the humanistic content of any subject lies in its history. Well, history is built-in the humanities. You can't teach art or letters without teaching its history. But science can be taught; it is too often taught, as formulas, weights and measures. Yet science is the product of historical development. It is the one truly *cumulative* aspect of man's history. Science *makes* history, but is largely neglected by historians.

Bacon conceived of the history of all learning and Bacon insisted that such history would include the sciences and the humanities.

In the 1800s, a young German scientist, Liebig, detected phosphate and potash in the ashes of burned plants and found ammonia in the vapours. He tried all three in a barren plot of ground. Shortly Darmstadt became a cradle of agricultural chemistry. Artificial fertilizers were created which doubled the food capacity of Europe almost overnight. I have never found any reference to Liebig in any historical document.

Well, I picked up a text used at Carleton College called "European History, Renaissance to Waterloo," 752 pages. Science was mentioned on only 33 pages. Even worse, Toynbee's 600-page "Outline of History" did not mention Kepler, Copernicus, Galileo, Descartes, or Newton. What kind of a history of the world is it that leaves out Newton, the greatest investigator of all times?

The historians will think I am picking on them, and yet I'm not. In some ways we scientists are worse offenders. Unfortunately for the human aspects of science the study of the past isn't necessary. You can become a first rate research man in physics and chemistry without knowing the history that produced both. So the rich humanistic heritage of science is almost as badly neglected by scientists as by others.

We as scientists and technologists are so surfeited with information, so bogged down with the immediate job that we have neither the time nor the patience to inquire into the *meaning* of what we are doing. T.S. Eliot summed it up, "Where is the wisdom we have lost in knowledge, where is the knowledge we have lost in information?"

Yet you can take any product of science and technology, trace it to its ultimate origin, and you would see the end result of a long and continuing tradition embodying parts of man's unending record of failures, stupidities, and genius.

Lynn White, remarkable medieval historian, said "To be as concrete as possible, we shall not have built a new liberal education in democratic terms until we can give in our colleges a course on the internal combustion engine as humanly conceived as the course on Shakespeare's plays. Both are supreme expressions of the mind and should be studied as such." I agree.

But, dedicated as I am, I couldn't hold that an internal combustion engine is comparable with the works of Shakespeare. Nothing that man has ever done, no split atom, nor any other achievement is comparable with

CONTINUED ON NEXT PAGE

The germs of science as old as man

his words and phrases. Here is man's creativity at its greatest.

In the 1920s, on a 2,000-mile sledge journey in Antarctica, five companions and I mapped mountains and glaciers no one had ever seen. I wrote in my journal: "No work of art of which I have stood in awe, no symphony I have ever heard, ever gave me the thrill that came when I picked up a piece of rock and found it was the sandstone I had come all the way to Antarctica to find." This was true. It was one of the great spiritual experiences of my life.

But, if I had to change that experience for the satisfactions of having read and reread Hamlet, which is surely one of the half dozen wonders of the world, I would have to choose Hamlet; but, I don't have to choose. Neither do you. Both are part of a larger whole.

In old Europe, scholarship developed under an all-covering canopy of truth from the church, and force from the classics. Both are largely gone. The Hebrew-Christian tradition has become so tenuous that many theological schools say God is dead, and refer to our times as the post-Christian era. Twenty-four centuries of Hellenic domination are gone. Now there is no generally accepted view on fundaments as in the Renaissance. We are adrift without an anchor in a world of shaken beliefs.

That remarkable classical scholar, the late Sir Richard Livingstone, said: "We are a generation without either illusions or a positive faith, kept from collapse by dead convictions which still influence the conduct but are no longer anchored in our beliefs."

My thesis is a simple one: we've got to find some stronger unifying element in our intellectual life than any now apparent. Science, viewed historically, is the great untapped reservoir of humanism which can help fill the void caused by the decay of the classical humanism.

We have studied Aristotle as a great philosopher and metaphysician. Do we realize he was one of the great figures of science? Are we taught he was considered the greatest naturalist, the father of biology, the man who opened inquiry into physiology, embryology, comparative anatomy, and ecology? Darwin didn't know this, Darwin was fairly old before he heard of Aristotle. Then, he wrote: "I had not the remotest notion what a wonderful man Aristotle was."

My comment on the lost unity of humanist education is an expression of profound regret. All the great cultures—China, Athens, India—were held together by ideas based upon spiritual unity, and of all the things that are part of our lives, science and technology are the most pervasive. They diffuse more rapidly than any other. Literature and art remain provincial. But not science and technology. Their product is immediately understandable to all peoples. Scientific workers have a sense of world citizenship. Discoveries have significance only when communicated to other scientists. Scientific knowledge is a living, growing thing. Scientific knowledge must be used; it doesn't keep any better than fish.

The universal status of science, its proudest claim, is also its greatest opportunity. In an age characterized by perfection of means and confusion of ideals, the disciplines of science which admit no frontiers of race or creed, provide a basis for effective international co-operation. Science has long since made the world one community; a statement that cannot be made about any of the other avenues that man has followed in his quest for an orderly world. Today the contending forces which make the strongest appeal are the national and the racialist movements which deny this principle of science.

Science came into being and has evolved because man is curious; he's relatively intelligent; to become intellectually enlightened he had to have a desire to better understand his world, and in the broadest sense, science was the first common enterprise of mankind.

My fellow scientists know that it takes two or three thousands of millions of years to account for me. I have a documentary body, I am a museum of all life, I am a part of all that has preceded me; and science, like biology, like life itself, has grown not by revolution, but by evolution. The germs of science are as old as man.

When we use the word "science" now, we think of only four centuries. Yet it began when man got up off his front feet and began using stones for tools. Progress was infinitely slow, and then came the discoveries of the Egyptians, Sumerians, and Babylonians; and upon these the Greeks built their own system of knowledge. The historian who follows a single people finds them dust and forgotten, but their science lives on.

Science and technology have woven unity into our society—and we could not escape if we would. Here are two examples: the International Geophysical year began July 1, 1957, and ended theoretically, December 31, 1958. It was the greatest peacetime activity in mankind's history, with nearly 70 nations, 40,000 scientists in 4,000 stations from pole to pole observing planet earth. There was an almost magical quality about it. International barriers were lowered and closed doors opened. There was simplicity, flexibility, freedom from political consideration. At its peak, the whole secretariat consisted of only eight people.

It was carried out in a period of worldwide unrest, and yet, we demonstrated that it is possible to engage in rational and reasonable conduct at the scientific level, and that international scientific co-operation is the best model for worldwide organization.

And out of our I.G.Y. co-operative effort in Antarctica, the coldest continent, came the first thaw in the cold war. For from 12 nations there came the Antarctic treaty. Hear these words: "Recognizing that it is in the interest of all mankind that Antarctica shall continue forever to be used exclusively for peaceful purposes and shall not become the scene or object of international discord."

I believe the Antarctic treaty is a breakthrough of international importance. It may take its place alongside the Magna Carta because for the first time a large part of the world is dedicated, for the first time, to peaceful purposes. It is a treaty which

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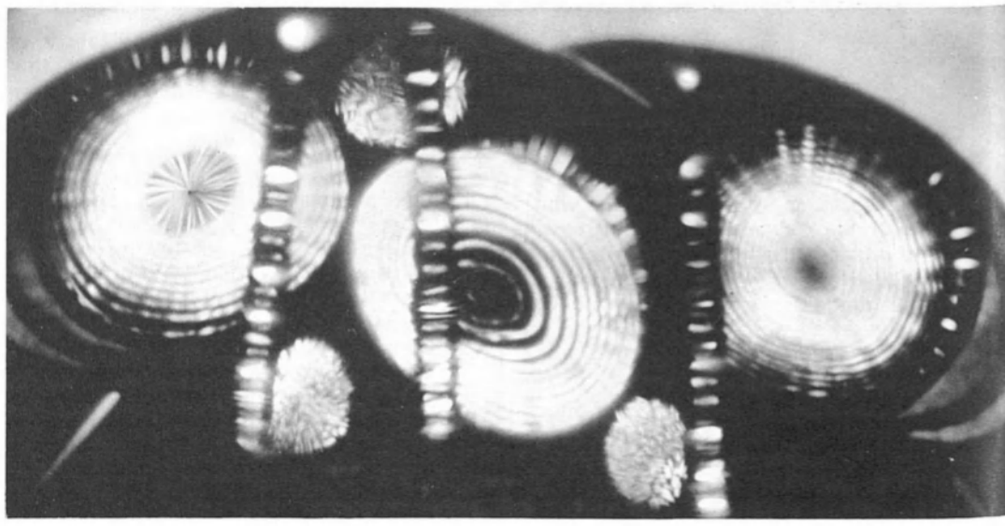

Photos © Frank J Malina, Paris

Art and science are combined in the work of Frank J. Malina, who is himself both an artist and a scientist. He has made an original contribution to art with his kinetic paintings, using electric light and real movement. Unesco recently acquired the work, left, "Ladders to the skies III", which now hangs in the reception room of the Director-General. Above, "Planetscape I", impression of extra-terrestial landscape (Will Feijer Collection, Chicago).

prohibits nuclear explosions; a treaty which provides freedom of scientific investigation, a treaty which is a precedent in the field of disarmament, history's first test-ban treaty. It is its first disarmament treaty. It is the first treaty designed to protect a scientific programme and then, by some kind of magic, the programme is implemented by the Scientific Committee which is not a government body at all. That may be one of the reasons it works.

As a result of Antarctica's isolation, it's the one continent that has never been the home of man, and the flora and fauna of Antarctica represent the only sizable assemblage of organisms anywhere almost uncontaminated by man. Neither by accident nor by design has man introduced new plants and animals into Antarctica. Perhaps one tiny part of our earth will remain as it was before man started spoiling it.

When I retired as president of Carleton College in 1962, the student body gave my wife and me two round trip tickets to Athens. I had over the years spoken so often of my fascination of classic Greece, that we did go to Athens and when we arrived, for some reason, I had a great reluctance to go and see what I had always wanted to see.

In the earliest things that I ever read, I became fascinated with two people—one was Abraham Lincoln and the other one was Socrates. I had read so much about the Acropolis, so much about the Parthenon that I was afraid to go see them.

Well, a remarkable Greek, Constantinos Doxiadis—a remarkable man who is doing things about pollution and many other problems—arranged for us to go up the Acropolis. We did, and as I stood in the midst of the columns of the Parthenon looking out over this beautiful city, it was one of the most thrilling experiences of my life, and I realized this was indeed one of the noblest experiences of the human spirit.

The next day when I had lunch with Doxiadis and said of the Acropolis, "This is the greatest and noblest expression of the human spirit I have ever seen", Dr. Doxiadis said, "Yes, but remember this. For its time, it was also one of the world's greatest engineering feats."

You see, the technology *and* the art that produced the Parthenon are parts of a larger whole.

Now, I want to quote from another philosopher, a friend of mine. He has been buried for more than 20 centuries, but he's more alive than two-thirds of us. His name is Plato, and he once said this: "What I'm saying may not be true, but something very like it is."

Photo © L. Ivanov - APN

Seated before a mural depicting turbulent cosmic activity, a scientist quietly ponders on problems of astro-physics.

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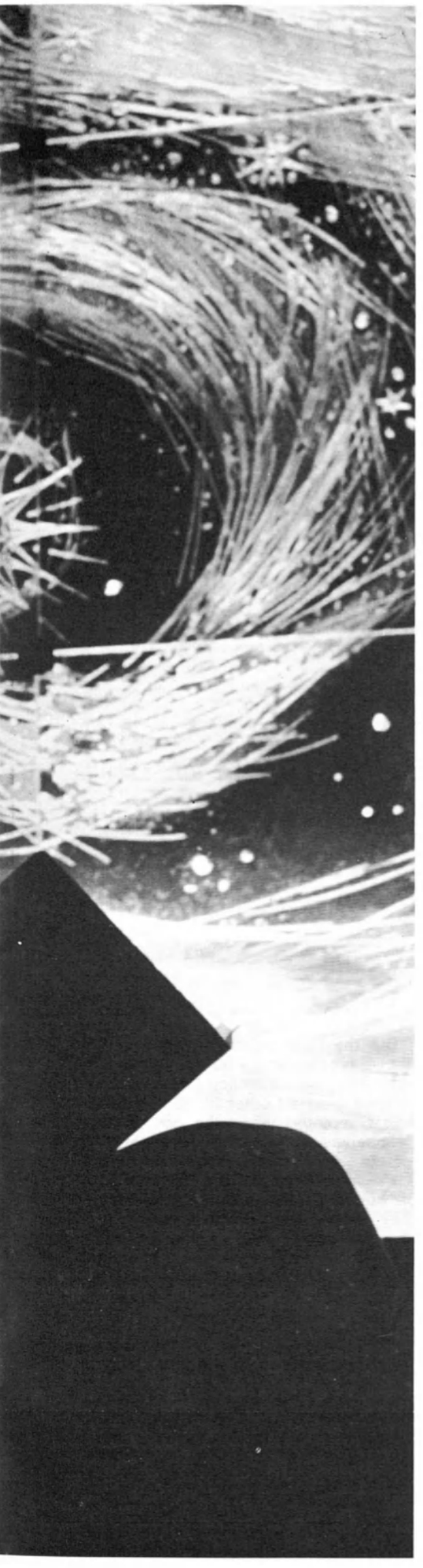

LILACS IN THE COSMOS...

by Lev Kassil

EVERY day mankind is gaining new knowledge. I am thinking first of the tremendous accumulation of new scientific data and the increasing flood of information available to and enriching modern society. Knowledge and achievement in all branches of science have developed to such an extent and become so highly specialized that no one nowadays can hope to become an Encyclopaedist like Diderot Montesquieu or Lomonossov. The age of the Encyclopaedists is long past. And as one of our great Russian scientists—Timiriazev, if I am not mistaken—has so rightly said, in our day a really cultured man is one who knows *everything* about a limited field and *a little* about everything.

Be that as it may, the power of world science has increased tenfold, penetrating alike into the infinitely great and the infinitely small, probing the depths of the universe, the atomic nucleus and the living cell. And as the quality of human knowledge has risen, so it has increased in volume, if we consider the distribution of knowledge among the inhabitants of our planet. Yes, undoubtedly mankind as a whole is growing more learned, more cultured, more civilized.

But can we say that man is the happier for it? Does knowledge alone make him more sensitive to the joys of living?

We know that if we are to be able to draw freely from all the springs that nourish human feelings, a knowledge of physical laws alone is not enough. We must also be able to see the world in affective terms. And here man cannot do without the arts. Victor Hugo said very rightly: "L'art c'est moi, la science c'est nous." (I am art, all of us are science.) Obviously he did not intend by this aphorism to lay stress on the specific individualism of art as opposed to the collective universality and levelling effect of science.

No doubt he meant that science is based on objective laws formulated after analysis, experiment and research. Once these laws have been demonstrated, confirmed and not contradicted by some new hypothesis or discovery, they are adopted in an identical manner by everyone.

A work of art, on the other hand, however perfect it may be and however universal its appeal, permits of a certain variety of assessments. Moreover, generalities apart, the artist's creation always expresses something of his own personal nature, reflecting his aspirations, tastes, sympathies and outlook.

IN any case, these are no grounds for antagonism between science and art. Nevertheless, from time to time there are signs of a recrudescence of the sort of debate carried on recently in the Soviet press. "Physicist or Poet?" was the title of this discussion—quite injustified in my view—which stirred up young intellectuals all over the Soviet Union where visitors on their first trip are often astonished by the tremendous popularity of art and poetry.

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LEV ABRAMOVITCH KASSIL *the Soviet writer and journalist has a scientific background (physics and mathematics). His many articles and books for young people are famous in the U.S.S.R.*

'Supersociety' and the yearning for beauty

It has been argued naively and even somewhat crudely that today science and technology give prestige to a nation, the two enabling us to unravel many of the mysteries of the invisible world and to carry man far out into space.

As for the arts, it has been maintained that nowadays the human spirit has little chance of expressing itself; and the advocates of science first and last have mockingly exclaimed: "Johann Sebastian Bach!... Alexander Blok!... Who needs them today?"

I should like to say that this sporadic episode met with little success except perhaps in a few schools where certain students—ill-prepared for their literature classes—tried to justify their unpreparedness by alleging that it was no longer necessary to waste their time on literature and the arts. This did not save them from failing their course.

I might add that the very theme of the debate—Physicist or Poet—was hardly original. In the years following the October Revolution, when part of the country's youth was tempted to join the hordes bent on destroying everything connected with the past, there were even some who denied any value whatever not only to classical art but to every form of art. I even recall the flippant motto: "Art is the opium of the people" and "Peace to the chemists, war on the creative artists!" (the latter deriving from the famous revolutionary slogan: "Peace to the huts, war on the palaces!")

VERY quickly, however, Lenin explained to the young that the people who had undertaken to build a new life could never attain this objective except by absorbing all the most precious products of human culture and in particular by making use of the countless treasures created by the arts throughout the course of human history.

But the final defeat of these scientific Savonarolas who proposed to establish the primacy of practical science over all other human interests was completed when the cosmonauts themselves—those who we might well expect to be the most forthright spokesmen of the avant garde trends of our age—acknowledged the help they had found in the great writers of prose and poetry, as they prepared their flights into space, and when the world learned that during their most trying moments, they found encouragement in music and song.

And so was born the lovely motto: "In the cosmos, too, there is a place for a spray of lilac." After all, science gives man knowledge, art gives him feeling. If there is a place in life for knowledge, there is also a place for feeling.

And here I might do well to recall the words of Anton Chekhov: "I wish people wouldn't see conflict where in fact there is none. Knowledge is

The level and scope of scientific knowledge is greater today than at any time in history. Yet the attraction of art and all forms of beauty has in no way been supplanted, and aesthetic education which enriches the human personality flourishes as never before. Here, happy children hurry to their music lesson.

Photo © Keystone

always present in the world Anatomy and literature are equally noble in origin. They have common aims and a common enemy—the Devil; there are therefore absolutely no grounds for conflict between them."

"There is no struggle for existence between them. If a man knows about the theory of the circulation of the blood, he is rich; if he adds to that a study of the history of religion and the song 'I remember a wonderful moment' (1), he becomes not poorer, but richer, and this again is wholly to his advantage. Men of genius have never warred with each other and, in the person of Goethe, we find side by side the naturalist and the poet."

It may seem scarcely worthwhile to have brought up all this at a time when the question, theoretically at least, seems to be settled once and for all. It is not without value, however, to recall the efforts to divorce knowledge from feeling because in practice the answer is still a long way off. Can we in fact honestly maintain today that the human race, as it gains in knowledge, is deepening and refining its appreciation of the beautiful?

In this connexion I am reminded of two conversations which I had with people of sharply diverging spiritual views. One of them, a devout Christian representing a religious brotherhood, said to me during one of my visits to the United States: "Beauty is God. If from youth you teach a person to see the hand of God and the will of God in everything around him, he will finally understand the harmony of all things, that is, perfect beauty."

The other, a Communist with whom I was talking at home—some time ago, it is true, after one of my lectures on the aesthetic education of young people—criticized me in the following words:

"Why clutter up their heads with that! The important thing is to foster a revolutionary conscience in people, a proper understanding of the laws of social development, to teach them the practical elements of social behaviour. The rest, including the sense of beauty, can come later."

IT is not my intention to enter into a discussion of the factors that have led to the great ethical and spiritual flowering of the human personality. I will simply say that in my view the purpose of all education is to give the individual the wherewithal to find happiness suited to his nature and to make his fellows happy.

As for the notion that our contemporaries can be completely happy, in the fullest sense of the term, that is to say, appreciating all the wholesome joys of life, without having had instilled in them a feeling for beauty—that is quite simply impossible. We are speaking here of the education of a human being completely and harmoniously developed, able not only to master knowledge but also to enjoy beauty and to share it with others.

For this reason, when we seek to achieve perfection as regards social organization and the distribution of material wealth, we must take great care, earnestly and in good time, to see that the future, does not merely hold out the prospect of a high material standard of living and a fair sharing of everything indispensable for material comfort. We must see to it that all society can participate in the world of beauty, the aesthetic world, the world of art. And this world must be accessible to all. We must encourage, foster and strengthen in each of us the desire to seek and find real beauty. And this cannot be achieved with mediocre products or worthless substitutes.

Why deny it: the man who lives in material comfort but disdains the world of art exhibitions, museums and art galleries leads the life of blind men. Little does he realize the joys and beauty he is missing.

The man who is interested only in the popular songs of the day, the music of which, though catchy and easily remembered, is nevertheless extremely limited, is in fact half deaf. For he has not learned to listen to and appreciate really great music.

Again, the man who has never read the great authors, the books which have moved the hearts and minds of millions of readers, if he has not learnt by heart a dozen or so lines of his favourite poet—if indeed he has one—that man is condemned to spiritual poverty, to live half-heartedly and to deprive himself of the greater part of those joys which spring from contact with beauty.

These contacts with beauty invite us to improve our personality and to take an active part in creating a life offering joy, satisfaction and consolation. The man who knows the meaning of beauty can reap the reward that dreams afford to help him to enjoy today and to face tomorrow with serenity.

This is a far cry from the narrow materialistic search for individual comfort. It is a romantic quest, inviting us to perfect our lives in all their plenitude. For the romantic approach is the centrifugal force which propels ideas and feelings beyond the horizons of everyday existence; it is the dynamic force which translates dreams into reality.

During my visits to the United States and Western Europe, I have been confronted with most varied manifestations of modern art. These, I must confess, have at times somewhat disconcerted me. Perhaps because it is an attempt to protect itself from the invading cybernetics of our time, with its yes-no and plus-minus responses, that art sometimes seeks refuge in the obscure realms of the subconscious and even illogical artificiality.

BUT years ago Tolstoy wrote that the beautiful cannot be devoid of meaning. Now that the electronic computer is capable of translating a book and even of writing simple poetry, the artist, if he is a true artist, cannot stand by with his arms crossed and watch the human factor disappear from the arts. On the contrary, today more than ever, art must reveal itself as in complete possession of all potentialities of the human spirit. The artist is the last bastion of those great gifts of man which can never be reproduced even by the most complicated electronic equipment.

At the same time it would be stupid to pit the power of modern science and technology against sensational and

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(1) Well-known melody by Glinka.

exaggerated notions of a "superman" which a certain press has popularized. True art, inspired by truth and beauty, exalts the splendours of the human personality, and seeks to help man to find his place in life and society, rejecting both the myth of the "superman" and of the "supersociety" which too often crushes the individual under implacable and inhuman laws.

Aesthetic education, of course, is inseparable from ethical education. Aesthetics and ethics should go hand in hand, both in the private world of the individual and in his relations with others. This unity must be created in infancy and must be talked about at home in the family circle. The harmony between the sense of the beautiful and the sense of right should be reaffirmed, strengthened and developed at school.

Unfortunately the time allotted to teachers in the school curriculum for initiating pupils in the realm of aesthetics—and above all in literature—is not being used to best advantage.

More often than not the great authors included in the Soviet curriculum are not properly studied; they are given only cursory examination. The children in class simply reel off in haphazard fashion the plots of classical masterpieces or of the best-known modern works.

IT is all too rare to find a schoolmaster, himself an enthusiast for his subject, who is able to communicate his personal admiration and attachment to his pupils so as to awaken in them a genuine love of the beautiful. Far more often the class repeats with indifference conventional views with no attempt to penetrate the real deeper sense or truth of the work. They make no attempt to find pleasure in a new experience so that under the spell of the author, they realize that what they were being taught was not boring and being forced upon them. Yet there can be no true education without education in ethics.

The Soviet Union has already achieved a great deal in the field of aesthetic education. We feel, however, that there is still much urgent work to be done. We have an Institute of Aesthetic Education attached to the Soviet Academy of the Science of Teaching where many aspects of the problems I have mentioned are being studied both scientifically and pedagogically.

Moscow has a Publishing House of Children's Books specially created to study the requirements of young readers, to guide and develop the tastes of children, and to assess and set aesthetic standards for children's books. We endeavour to ensure that radio and television should be not the rivals but the allies and supporters of literature, in a word, the auxiliaries of all who are concerned with the aesthetic development of the rising generations.

The Soviet Union comprises a large network of amateur artist groups to which millions of children and adults belong. There are popular theatres, literary circles, and art studios. Even so, we must admit that the general level of artistic taste and aesthetic appreciation lags far behind that of general technical education in the Soviet Union. In this field we still have a long way to go.

Painters, scientists, writers, musicians and teachers should combine their efforts to enable society not only to expand the scope of its knowledge, but also to make it possible for everyone to take the bold step of exploring the world of aesthetics and the world of the beautiful.

From the infinitely great to the infinitely tiny, science is enlarging the bounds of the universe and those of life itself. Simultanously it probes the mysteries of space and those of the living cell and in the process uncovers hitherto imperceptible forms of beauty. Below, a symbolic model of the molecule of DNA (desoxyribonucleic acid). Science has shown that these molecules are the fundamental building blocks of heredity.

Photo © Holmes - Lebel, Paris

SCIENCE AND FUNDAMENTAL CONCEPTS OF THINKING

by Paul Couderc

Winner of the 15th Kalinga Prize for the Popularization of Science, awarded by an international jury appointed by Unesco, the French astronomer and science writer Paul Couderc outlines, below, his views on the need for impartiality in science, and for regular science information to be available to everyone.

THE triumph of science must ultimately engender peace by endowing **all** mankind with better means of livelihood, more leisure, more culture and reasoning powers. Progress put an end to the age of the cave-dwellers; why should it not put an end—and the sooner the better—to the age of the barrack-dwellers?

The time is not long past when science was regarded as suspect and frightening. Opprobrium was poured on its ruthlessness, on the "cold-hearted scientist" and his materialism, which was equated, unfairly, with the negation of any ideal (instead of being contrasted with professions of so-called idealism, as it properly should be).

The "cold-hearted scientist" is one of the myths most widely propagated by the enemies of science and especially by the zealots of spurious science and occultism. It is obviously easier to deceive the multitude when one is dealing with those who "respect the mystery at the heart of things", who can be fobbed off with pure verbalism and who confuse irrational belief with reasonable knowledge.

This bane of scientific illiteracy may perhaps have lost its hold; people nowadays seem increasingly conscious of the handicap of insufficient scientific knowledge in the modern age. Henceforth, science is a factor of vital social importance. It offers man the only chance of building a better future and breaking his fetters; it is the only means of assuring man a longer, easier and happier life.

In our vindication of science, we are not confusing material comfort with happiness. The individual rarely owes his happiness directly to the pursuit of research. Moreover, the seat of happiness is in the emotions rather than the intellect—the joys of the family, moral satisfaction, deep-felt emotions aroused by music, poetry, literature, films or the theatre. Scientists are no more beyond the reach of feeling than other men, nor do they wish to be.

But obviously, art and enjoyment demand freedom and leisure. When prehistoric man spent all his waking hours protecting himself and finding food, he hardly had time for meditation or amusement: this explains the extreme slowness of early progress, contrasted with its remarkable speed today.

Those who belittle scientific achievements have forgotten the advances made in medicine and surgery, the alleviation of pain and sleeplessness. The expectation of life has doubled in fifty years, and life has become less arduous.

Science moves so fast and has become so vast and complex that the man in the street can no longer fully participate in the life of his time without some intelligent popularization of knowledge. Even the scientist needs popularization in fields other than his own.

Popularization aims to make the march of science intelligible to the layman, in simple, clear, direct and if possible vivid, but above all accurate terms. The attempt can never be completely successful, for over-simplification always entails some deformation; especially as the profoundest scientific truths, in nuclear physics or cosmology, for example, are now becoming so abstruse that there is great danger in deviating from them even slightly. In any event, the popular science writer must take care not to slip into sensationalism or triviality. The reader must be prepared to make an intellectual effort: he must want to understand.

Furthermore, the new ideas and images of the universe must infiltrate education as soon as possible and become part of every schoolboy's

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PAUL COUDERC, *astronomer at the Paris Observatory and lecturer in astronomy at the Ecole Polytechnique (Paris), has written widely on cosmography and the structure of the universe. Many of his books have appeared in the "Que sais-je ?" collection published by Presses Universitaires de France (Paris), among them: "La Relativité" (1966); "Les Eclipses" (1961); "L'Univers" (published by Arrow Books, London, as "The Wider Universe", 1960); "Le Calendrier" (1961); "Histoire de l'Astronomie" (1961) and "L'Astrologie" (1957).*

The star in the suburbs

stock in trade, to ensure that the gulf is not too wide between ordinary thinking and the mental processes of the research scientist. We call the properties or relationships we learnt at an early age "self-evident".

If steps were taken to keep education up-to-date, everyone would start on the same intellectual footing in each country, or very nearly so; and some inter-communication would be possible between the privileged few who wrest from nature her secrets and the multitude who can now do no more than benefit from the applications of science.

The people will become an inexhaustible store of new research workers, provided they are informed and instructed in a scientific spirit, not one of mystery, and are shown the hallmarks of real scientific proof, instead of the vain pretensions of spurious science. From the ranks of those still barred from the high schools and universities by a selective social system that is deplorable, many men of science might emerge, and once in a while a genius.

Think of the cases (only too rare) where a brilliant mind has been rescued, by some lucky chance, from an occupation with no future. Think, for example, of Faraday, the bookbinder's workman, who fathered the prodigy of the present day electrical industry; think of Alexander Fleming, the son of poor Scottish moorland crofters, who worked for five years as a clerk in a shipping company, until a small legacy enabled him to take up medicine; but for that legacy, we should probably still be without penicillin and the other antibiotics.

I should like to illustrate by the example of astronomy how the evolution of science can change the laws of human reasoning.

For primitive tribes the world is a frightening place. They have an affective conception of the universe: they people heaven and earth with higher powers, capricious and menacing, whom they must endeavour to placate. Meteorology is confused with astronomy, and there is no inkling of natural law.

This was undoubtedly the world of prehistoric man. But little by little, the alternation of day and night, the unvarying sequence of the phases of the moon, the succession of the seasons, provided the primitive peoples with time units, and led to the notion of regular cycles in the universe.

In the sixth century before our era, in the Eastern Mediterranean, the earth was identified as a celestial body, spherical and surrounded by space, from the observation of its shadow on the moon in eclipse and from the progressive change in the field of stars visible to the traveller.

The idea of a single vertical dimension, and the notion of up and down, were gradually superseded by the concept of an infinite number of vertical dimensions converging towards the centre of the earth, and the possibility of being able to stand upright at the antipodes. What a revolution in thought!

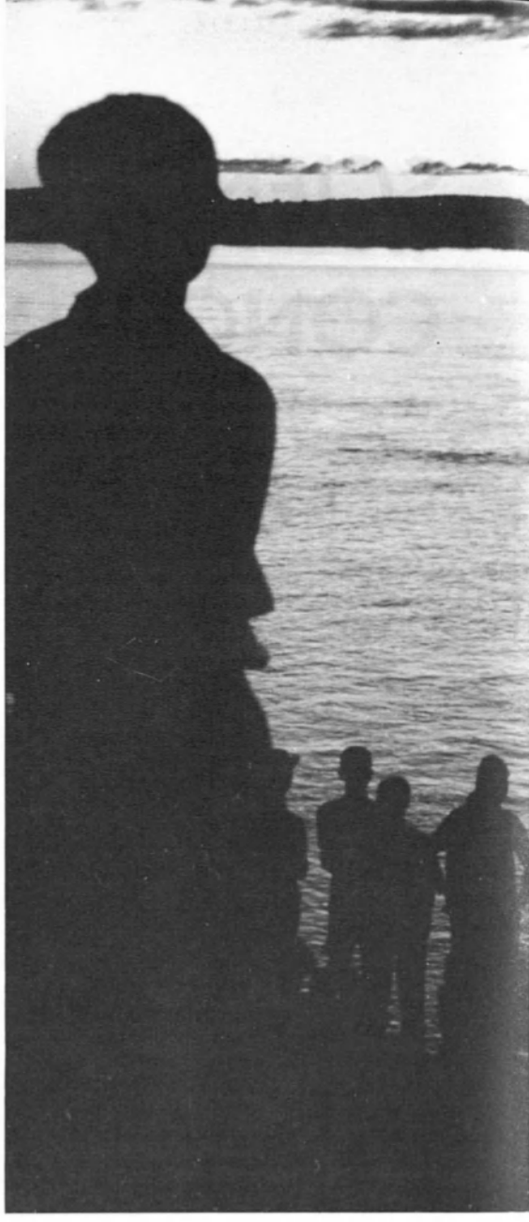
Similarly, the concrete reality of darkness, with the antithesis of light and dark, was superseded by the notion of shadow. Only light is real; darkness is merely the absence of light. This vital step forward was also due to an understanding of the eclipses and the phases of the moon.

NEXT, the attempts of the Greeks to account for the movements of the planets geometrically mark the final advent of scientific rationalism: from then on, it is assumed that any natural phenomenon can be explained; the concept of natural law carries all before it, ousting the supernatural and fantastic. Mystical needs still have their place, but as a thing apart, hardly impinging on science.

Fifteen centuries later, Copernicus and Galileo supplied the proof that the earth is not the centre of the universe. This changed the whole face of philosophy; the inhabitant of a modest planet revolving round the sun cannot think along the same lines as a privileged denizen of the centre of the universe. A study of our galaxy now shows the sun to be a star in the suburbs of a multitude of hundreds of thousands of millions of other stars like it: and the giant telescopes reveal that the universe is filled with thousands of millions of galaxies similar to our own.

Lastly, these galaxies are running away from each other in an expanding universe, where space itself is not only curved but dilating. What, then, is space? Matter? Gravitation? At this very time, these questions are moving from the metaphysical to the scientific plane. Thus, science again appears as the "power behind the throne" in our philosophy, returning the fundamental concepts of our thinking to the melting-pot.

Astronomy is still in the forefront of the natural sciences, and the most abstract ideas are invoked in contemporary cosmology. At the same time, allying as it does the beauty of the stars and the poetry of the heavens to infinite scales of time and space, it remains a particularly apt medium for bringing the conquests of modern science within the grasp of the general public.



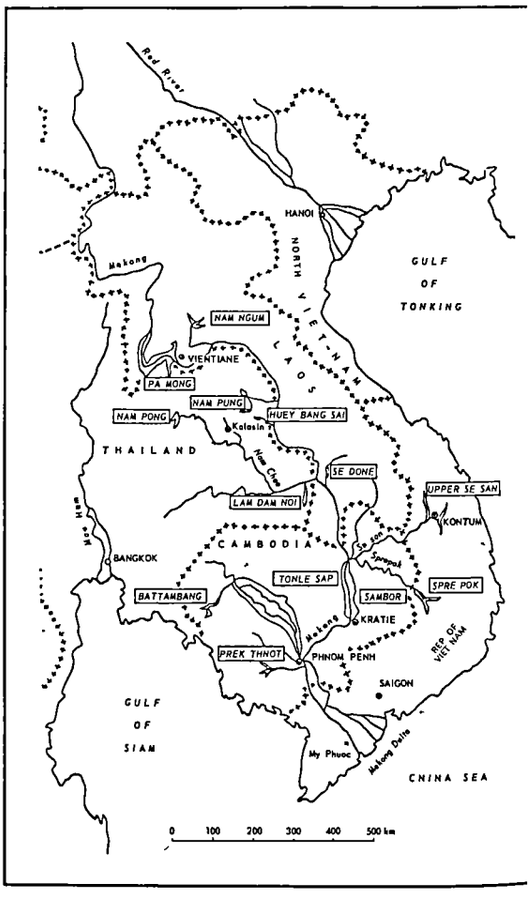


Photo USIS

Unesco mathematical model to harness the Mekong

by W. J. Ellis

The Mekong Project, an historic international enterprise in river development, seeks to make full use of the waters of the lower Mekong in terms of hydro-electric power, irrigation, flood control, drainage, navigation improvement, water management and water supply. Map left, shows location of some of the Mekong projects in Thailand, Laos, Cambodia and the Republic of Viet-Nam. Unesco has produced a Mathematical Model of the Mekong Delta which has already played a major role in proving the feasibility of building a barrage across the Tonle Sap River (Cambodia) and will be used to study other projects. Above, a boat race along the broad waters of the Mekong at Vientiane (Laos). The occasion is the annual regatta marking a Buddhist festival in October.

THE 2,600-mile-long Mekong, one of the great rivers of the world, rises at an altitude of over 16,000 feet in the mountains of perpetual snow of the Tibetan plateau.

It is perennial and flows unrestricted through Yunnan Province in China and Burma before it enters the Lower Mekong Basin, where, in Laos, Thailand, Cambodia and the Republic of Viet-Nam, it is influenced by the monsoon rains collected mainly from the enormous catchment of the Annamese Cordillera. Only 14 per cent of the river's water has its origin in Tibet and China.

From the Burmese border, the river follows a tortuous course for sixteen hundred miles before it is lost through the great delta into the South China Sea.

It is estimated that the total drainage area is 307,000 square miles (800,000 sq. kms.) and of this, 236,000 square miles (600,000 sq. kms.), an area larger than France, lies within the four countries of the Lower Basin.

Nowhere in its long journey has

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W. J. ELLIS, *of Australia, was formerly director of Unesco's Science Co-operation Offices in South East Asia (Manila) and South Asia (Delhi). He is now with the Unesco Secretariat in Paris. Before joining Unesco he was a biochemist on the staff of the Commonwealth Scientific and Industrial Research Organization in Melbourne, Australia.*

LIFE ALONG THE MEKONG RIVER

Rice eaten with salted fish or a fish sauce rich in protein is the staple diet of the population in the lower basin of the Mekong. River fishermen make their largest catches as the annual flood waters recede along the Tonle Sap, a tributary of the Mekong, in Cambodia. Improvised markets are set up on the river banks to which the rice farmers, travelling from far afield, bring their grain to exchange for fish. Opposite, airview of the Cambodian countryside reveals a mosaic of flooded ricefields. The proposed barrage on the Tonle Sap would help to control flooding, extend the fishing season and improve soil fertility. Below, countless numbers of fish await processing at riverside compounds. Left, rice farmers encamped by the Mekong prepare piles of fish for salting.

Photos © Raymond Cauchetier, Paris

Photos USIS

MEKONG *(Continued)*

A 2,600-miles river without a bridge

the river ever been crossed by a bridge and at no time until recently has anything been done to derive greater benefit from the river or to control its many and unpredictable idiosyncrasies, though these cause great losses to the already over-taxed economy of this area.

The Mekong has an annual cycle, with a dry season from November to June and then a regular flood which usually reaches a single peak.

When the floods come, over 15,000 square miles (38,000 sq. kms.) in Cambodia and the Republic of Viet-Nam are inundated. Herein lies the major problem, that of introducing some control over this yearly phenomenon. One of the special features of the flooding is that by the time the enormous volume of water reaches Phnom Penh, the capital of Cambodia, sometimes reaching a height of thirty feet, the head developed by the Mekong is sufficient to reverse the flow of one of its principal tributaries, the Tonle Sap. This river flows backwards into the Great Lake of Cambodia.

THUS it may be seen that the daily life of the inhabitants of the Mekong basin has always revolved around the vicissitudes of the monsoon and the river. Over the centuries they have learned after a fashion to adapt their way of life and their livelihood to these difficult conditions.

It has therefore been necessary to bear well in mind that any development plans call for careful co-ordination of all factors concerned and to ensure that what is planned will not disrupt the present economy and the whole ecology of the region. Since rice and fish constitute the daily diet of such a large proportion of the population, even a brief interruption of supplies could have serious consequences.

Of all the projects considered or planned for the Mekong the most promising and most complicated one is the Tonle Sap project. Here, it is proposed to build a great barrage, and planning for it has called for the development by Unesco of a mathematical model.

Over the past seven years Unesco and the United Nations Development Programme (UNDP) have been engaged on this highly sophisticated research project—the creation of a theoretical model in the form of a computer and programme of the Mekong River Delta, as distinct from a physical model which is built to scale and which is usually used for the study of hydrological problems of this sort. In the present instance the term Mathematical Model is used by the specialists and it has been made possible by the use of an electronic computer.

While this model has made a special contribution to basic studies of a number of development projects being undertaken in the Mekong Flood Plain, it has also led to fundamental scientific advances in the field of hydrology and hydraulics.

This project is an example of international scientific collaboration at its best. Born out of a spirit of co-operation between the United Nations and the four countries, Cambodia, Laos, Thailand and the Republic of Viet-Nam, which are most closely concerned with the Mekong, the new techniques developed will serve other states far distant from South-East Asia. For example, the study of many of the flood problems of Italy may well be assisted by the application of the scientific knowledge resulting from the Mekong studies, and thus a recurrence of the enormous damage caused by the devastating floods of 1966 may be prevented.

DURING recent years the experience of many has been sought out to see how the Mekong as a vast natural resource might be turned to greater use and thus contribute to an improvement in the economic situation of the population of the great flood plain.

The Lower Basin of the Mekong River comprises approximately one third of the total territory of Cambodia, Laos, Thailand and the Republic of Viet-Nam, and within it live 20 million people. Eighty per cent of them are farmers and fishermen and all are dependent on the river.

Less than 3 per cent of the basin is irrigated; much more of it could be and will be under the development plans. Only 86 per cent of the cultivated land is under rice, and only one crop a year is grown, but this could be increased to three. With electric power becoming available it will be possible to produce nitrogenous fertilizer. Furthermore, large abandoned areas like the Plaine des Joncs could

One of four U.N. Special Fund projects on tributaries of the Mekong provides for the construction of a dam on the Nam Ngum River in Laos. Far left, site chosen for the dam as it looks today. Left, artist's impression of the future dam, 200 feet (66 metres) high and nearly 1,200 ft. (360 metres) long. The jungle spreading to the hills in the background will be engulfed by a vast artificial lake covering 140 square miles (370 sq. kms.). The project should bring irrigation to about 100,000 acres and generate 520 million kilowatt hours of electricity a year. Right, lowering a current meter into the Mekong during preparatory studies for the River Basin project.

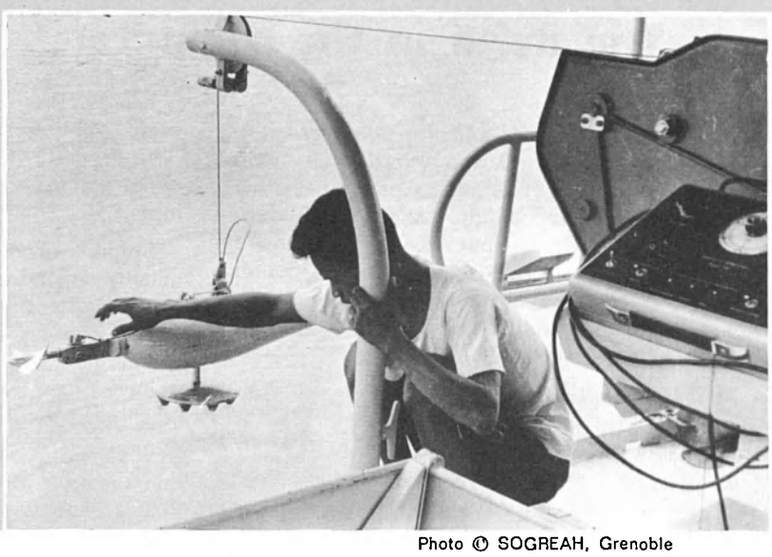

Photo © SOGREAH, Grenoble

well be brought under cultivation if they were desalinated.

The advent of power could also make it possible to work the iron ore, bauxite, copper, tungsten and zinc which are found in the area, and to set up new industries. These will call for increased educational and extension programmes for the people to enable them to understand the new development, to acquire new skills and to adapt the existing social and commercial structures.

The fishing industry, about 90 per cent of it fresh-water, is extensive and important, with the Great Lake producing about 50,000 tons per year. But this production is very variable and it is foreseen that if the proposed barrage on the Tonle Sap could be regulated the fish production might be more balanced.

Whatever might be the sum total of benefits from a barrage on the Tonle Sap it is clear that there would result a tremendous reduction in the loss of lives and property. For example, in the 1961 flood, 164 lives were lost and a population of over 300,000 affected; untold damage was done to buildings, roads and bridges.

The problems of the Lower Mekong Basin can only be solved as a whole: there is need for a joint effort, but not even the four countries involved could assemble anything like the necessary technical and material resources required to carry through a project of this magnitude. This then was a real project for study and assistance by the United Nations.

In 1951, the Economic Commission for Asia and the Far East (ECAFE) established by the United Nations Economic and Social Council in 1947 took up the study of the Lower Mekong. The technical work was undertaken by the Bureau of Flood Control and Water Resources Development, a subsidiary body of ECAFE which is empowered, among other things, to advise and assist governments on flood control and related river problems. The first study, published early in 1952, aroused keen interest and brought forth favourable response.

In 1957, a United Nations mission planned a five-year programme of surveys with a budget of $9 million. The first recommendation, which received early approval of the United Nations, was the creation of a local authority to draw up a master plan and to ensure proper co-ordination of resources.

Thus was established the Committee for Co-ordination of Investigations of the Lower Mekong Basin, which is composed of plenipotentiaries from the four riparian states of Cambodia, Laos, Thailand and the Republic of Viet-Nam. It is empowered to control supervise and co-ordinate development projects. To handle the vital day to day work between sessions of the committee an executive agent was appointed and, to assist him, a three-member consultative committee. This small operational body puts into effect decisions taken by the Committee for Co-ordination.

Pilot projects have been started, and are well under way in each of the four states. These are the four Mekong United Nations Special Fund tributary projects:

■ The Battambang Project in Cambodia envisages a diversion dam. But, since the river is almost dry during April and May, round-the-year irrigation cannot be ensured simply by providing such a diversion dam. It is proposed to solve this problem by building an upstream storage dam and reservoir, which should provide gravity irrigation for 150,000 acres. In addition it is planned to generate 110 million KWh of electricity per year.

■ The Nam Ngum Project in Laos is to provide irrigation for farming on about 100,000 acres and will produce about 520 million KWh of electricity per year.

■ In Thailand the Nam Pong project located in the north makes provision for pumping and irrigation to about 95,000 acres and provides for the drainage of soil which is sandy and often very salty. It will also produce some 90 million KWh. of electricity.

■ Finally, the Upper Se San Project located in the plateau area of the Republic of Viet-Nam is designed to develop a large area for resettlement. The project will provide gravity irrigation for some 25,000 acres downstream and, by pumping and upstream diversion, for an additional 35,000 acres. The production of 220 million KWh. of electricity is planned.

These then constitute the four UNDP Special Fund Component projects which aim to irrigate slightly more than 400,000 acres; and additional tributary projects will doubtless be built.

A number of mainstream projects

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The delta in the computer

are under way and are being assisted under bilateral aid and the Colombo Plan. (The British Commonwealth's scheme for aiding its member countries in South-East Asia.) Five of these projects envisage providing irrigation to an area of nearly 6 million acres and an annual electricity output of about 25,000 million KWh.

The Tonle Sap and Delta project is one of especial interest to Unesco as the organization entrusted by UNDP with the making of the mathematical model of the Delta.

Quite apart from these large-scale land and water development projects other work is in progress undertaken by the four riparian governments which are receiving bilateral assistance as well as aid from the United Nations and other international agencies.

FOR example the U.N. is carrying out a survey of minerals and the mineral processing industries in the Mekong Basin. In agriculture, the Food and Agriculture Organization (FAO) is helping with the development of a 740-acre experimental irrigation and demonstration farm in the Vietiane Plain, under the Special Fund Component Tributaries Project. FAO is also assisting by directing the design of a number of agriculture stations.

Because of great losses from forest and grassland fires caused by shifting cultivation, FAO is investigating ways which may be used to restrain this practice. Schistosomiasis (a disease caused when the bloodstream is invaded by tiny parasites) and malaria surveys have been carried out by the World Health Organization, and preventive measures suggested.

At the request of the Co-ordination Committee, the International Labour Organization has completed a preliminary manpower survey of the Mekong Basin.

The change of flow of the Tonle Sap caused by the swelling of the Mekong at flood time has already been mentioned. This constitutes a major hydrological and hydraulic problem, and a detailed scientific study was considered to be fundamental to any plan for building a barrage on the Tonle Sap and indeed basic to most of the projects envisaged for the whole Lower Mekong Basin.

Having in mind the need for a thorough basic study, Unesco constituted a three-man mission to visit the area and to look into the idea of constructing a suitable hydrological model.

Studies of hydraulic problems are usually carried out by using a physical scale model, but in this case the relations between surface distances and gradients were of an order that made it almost impossible to reproduce such small slopes in a model.

Such a model would have required an area of almost one hectare (2½ acres) with levels accurate to 1/10 mm. This important consideration, among others, led the Unesco Mission to propose the development of a mathematical model, to be prepared by using an electronic computer.

Accordingly, the Committee for Co-ordination, on behalf of the Governments of Cambodia and the Republic of Viet-Nam asked the UNDP Special Fund Component for help in building up a mathematical model of the Delta. The project was approved and in May 1961 the Governing Council of the Special Fund entrusted Unesco with the responsibility for building the model.

The mission contemplated the building of a model for two major reasons. Firstly, they considered it necessary to resolve the controversy existing between experts about the total effect of building the dam and also to prepare a design that would provide the most efficient control. Secondly they felt it was vital to demonstrate clearly that a dam built in Cambodia would not in any circumstances adversely affect the lower part of the Delta in the Republic of Viet-Nam.

AT the time of the mission's work a physical model had already been ruled out. A new approach was being made and new developments were taking place which eventually made it clear that a mathematical model was more suited to the investigation. That the decision to use a mathematical model was taken at a time when the technique had not yet been fully developed can be considered as an important contribution to fundamental hydraulic studies.

Very careful planning was required in preparation for the model. First a panel of consultants was appointed—three hydraulics experts and two mathematicians—who contributed the expert knowledge and experience of the four different countries from which they came. Then a suitable laboratory had to be found to undertake the construction of the model. The one selected, SOGREAH—the Société Grenobloise d'Etudes et d'Applications Hydrauliques—in Grenoble, France, had had years of experience of research in this field.

THE model project was planned to cover four phases:

- The collection of all existing documentation and data on the hydraulics of the region;
- The designing and programming of a preliminary model on the basis of these results which could determine the possible deficiencies of the eventual model;
- A measurement campaign planned on the basis of the preliminary model, which would check the critical data needed for improving the accuracy of this model in preparation for the final stage;
- The construction of the eventual model, in the form of a computer programme accurately representing the seasonal variations in water levels and discharge rates.

In phase two, trial runs were made to determine how faithfully the preliminary model reflected the natural phenomena. The main purpose was to determine which factors (discharge rates and levels at particular points for instance), were critical for the operation of the model, adjustments being possible to make it more accurate.

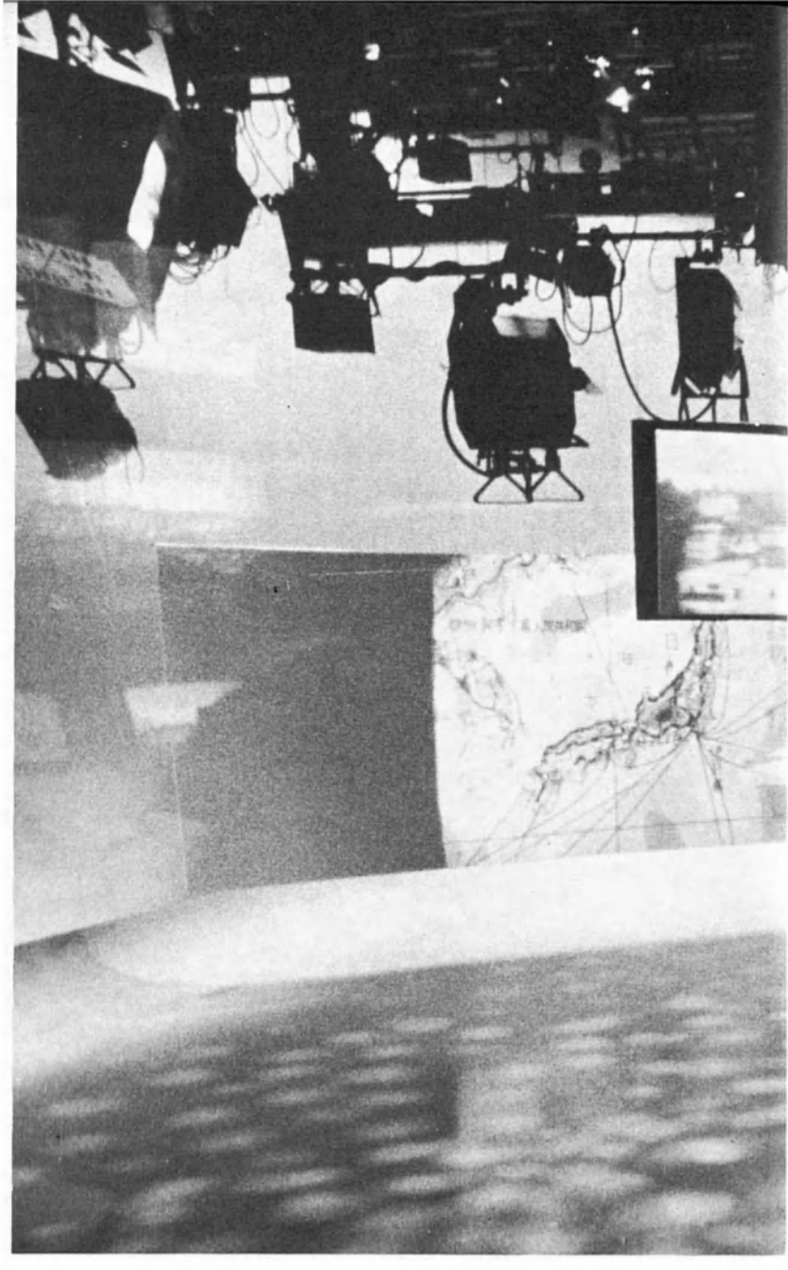
Essentially the computer programme constituting the Mathematical Model involves the introduction of detailed hydraulic data (topographic features, water levels and discharge volumes etc.) into an electronic computer in the form of formulae embodying well known physical laws. The computer then determines the water levels and their rates of variation at the points and times of special interest in the Delta plain.

The test area concerning the Tonle Sap was divided up into more than 260 meshes covering dry land, water or marsh from which the natural phenomena could be faithfully reproduced by definition of the exchanges between them and the average water levels in each of them. Each mesh entailed a great number of accurate and painstaking measure-

CONTINUED ON PAGE 32

Photo © Raymond Cauchetier, Paris

FISHING VILLAGE AFLOAT on the Great Lake that feeds the Tonle Sap River. In the rainy season the rising waters of the Mekong reverse the current of the Tonle Sap and cause it to flow back into the Great Lake, raising its level by some 30 feet. The fishermen and their families live permanently on their boats and at high water periods cast their lines and nets almost at tree-top level.



On June 25, 1967, satellites were used to relay a live programme simultaneously to television audiences in Japan, Australia, North America, Europe and North Africa. Photo shows an opening shot from this programme, "Our World," presented via the B.B.C. Television Centre in London.

Communication satellites

The new music of the spheres

by Wilbur Schramm

With the latest advances in technology it is foreseen that in the next 10 years our TV screens will be able to receive world-wide programmes via satellite relays. The real problem today is not so much the need for more perfected satellites as better plans for using them for a vast exchange of educational, scientific and cultural programmes. Professor W. Schramm, a world authority on mass media development, here looks at a few of the major problems that call for solution before the intercontinental exchange of news and cultural programmes can become a day-to-day occurence.

THE opportunity now exists to share data over long distances as never before in the history of mankind. The development of computers of great capacity has made it possible to store enormous quantities of information in digital form, and to search efficiently for and retrieve any part of what is stored. The development of related arts and sciences of indexing, abstracting and programming has brought into being a new force in human affairs —information science.

Fortunately for us, these developments come at a time when many of the natural sciences are experiencing

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WILBUR SCHRAMM *is director of the Institute for Joint Communication Research at Stanford University, U.S.A. and the author of many books on mass communication. A number of his studies have been published by Unesco "Communication Satellites for Education, Science and Culture", 1967 ($1.00, 6/-), on which his present article is based; "The Effects of Television on Children and Adolescents", 1964 ($0.75; 4/-), "Mass Media and National Development (The Role of Information in the Developing Countries) 1964 ($6.00, 30/-) Professor Schramm is now directing publication of a series of studies on the use of modern teaching techniques in the developing countries, based on surveys made by the International Institute for Educational Planning.*

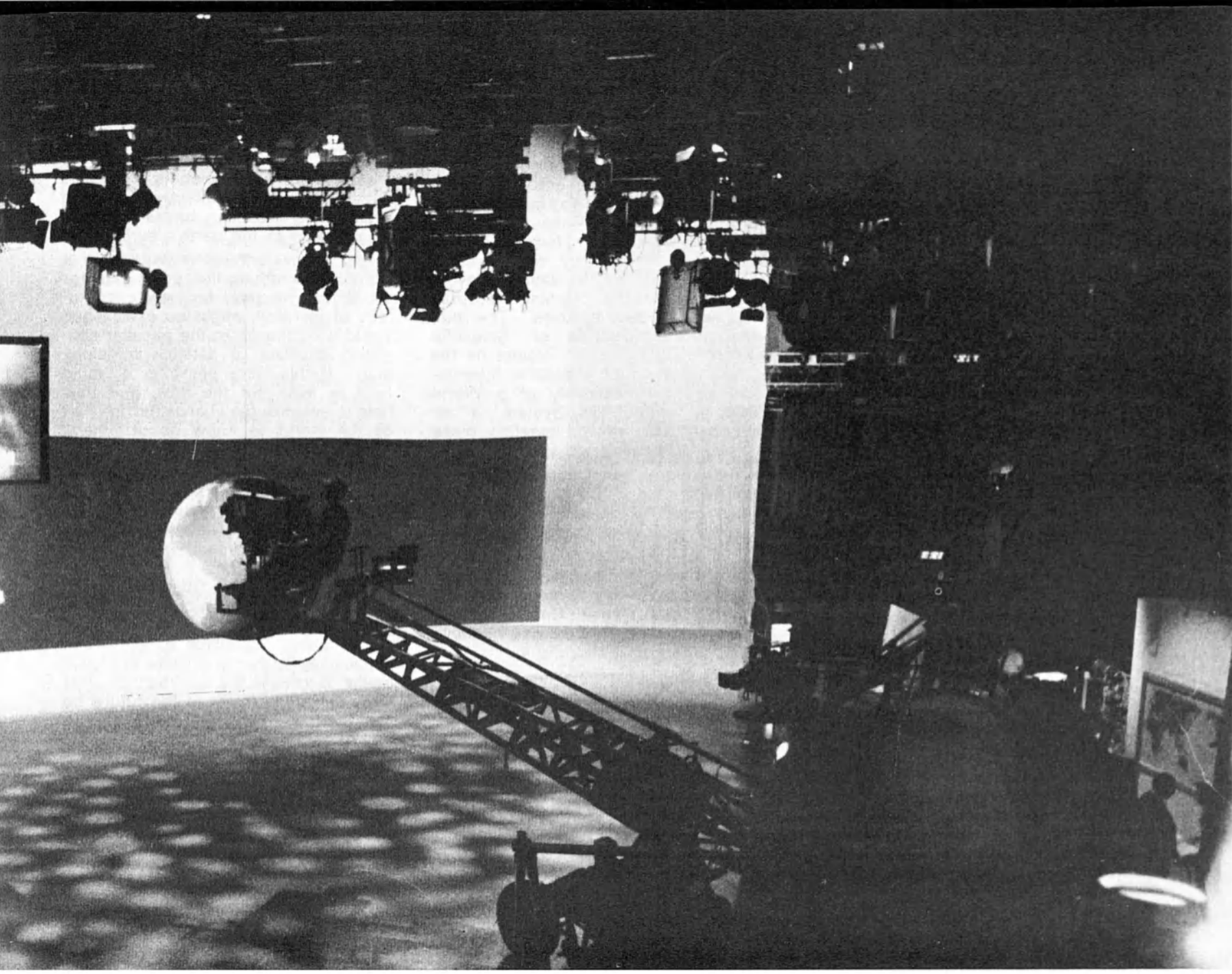

Photo European Broadcasting Union

a glut of research information, when information of great importance to scientists is being produced at many and distant places on earth, and when rising educational levels and expanding scholarships are creating new needs for information world wide.

In this race between information needs and new information capabilities, communication satellites will play a facilitating role, and probably an important one.

Indeed, some space scientists have predicted that communication satellites may be used more for data than for telephone transmission. Their function will be to extend the connexion between data sources and user.

Already computers have been connected to other computers or to data consoles, over thousands of miles, by means of land lines. They can also be connected by satellite.

Weather data have been exchanged, by words, numbers and pictures, over almost all the world, by satellite. Telemetry and even television from satellites have been received on earth from many hundreds of thousands of miles away in space. Can we now adapt these proved capabilities to the needs of scientific and educational information?

Men have dreamed of a new age of information. Great data banks, established centrally, would be available to the most distant users. Scientists in developing countries or at isolated locations would have as ready access to scientific research as would their colleagues in the great centres. A sick man in a distant location could count on the help of a great medical centre. There would no longer be a stultifying lag between new knowledge and its dissemination. New findings in medicine, for example, would be promptly available to clinics and hospitals and medical schools everywhere.

The resources of a small town or school library would no longer be a few hundred or a few thousand volumes; there would be available by quick data transmission, when needed, the enormous resources of such great information centres as the Library of Congress, the British Museum, or the Lenin Library.

National, and ultimately international, information systems would come to be realities, and computerized indexing and cataloguing would take much of the drudgery out of working with them.

Let us not mistake the dream for present reality: we are far from being able to make that kind of dream come true. But we can already do remarkable things in using computers for information storage and retrieval, and it is safe to say that whatever we can store on a computer we can transmit and retrieve at the end of a satellite circuit.

Present needs, as we move toward full use of satellites for scientific and educational data transmission, are to establish the demand for such data, the locations where it exists, the forms in which it must be packaged in order to be useful, and the institutions and organizations which must come into being in order to collect and disseminate it. This is planning of a high order which must involve many sectors of the academic community and the information professions.

International data exchange will require building up *national* capabilities for information exchange.

How can an organization like Unesco best contribute to this growth toward international data exchange, in which

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Libraries in the sky

Photo © Keystone

A talk on Greek poetry in the television series, "The Sense of Poetry," produced by the educational TV station in Boston (U.S.A.). With the use of communication satellites, completely new possibilities are open to educational radio and television in every country and notably in the vast areas covered by the developing countries.

communication satellites will play a considerable part?

It seems that the greatest contributions might come: (a) by helping to share with the smaller and newer countries what is being found out about information technology and dissemination, and (b) by facilitating in every way possible the planning for truly international data systems. The joint International Council of Scientific Unions (ICSU)-Unesco Project on the Communication of Scientific Information and the Feasibility of a World Science Information System is an important step toward meeting these objectives.

The central committee designed to supervise the ICSU-Unesco Project could serve as the nucleus of a commission or advisory group on information exchange.

International information exchange will become a very large activity. It may be that a new United Nations Specialized Agency or bureau will have to be organized to handle it.

Communication satellites offer an opportunity to increase and even out the flow of news in the world. It has been amply demonstrated that news flow falls off markedly with distance (geographical or psychological) and that the flow is overwhelmingly from the more developed countries to the less developed ones.

Experience has shown that whenever cables have been extended to a country there has been a notable improvement in both the speed and quantity of news available to readers and listeners in that country. Therefore, there is reason to believe that satellites can potentially make a real difference in news availability throughout the world.

In theory at least, this should occur at each stage of satellite development. In the relatively distant years of direct broadcasting we may be able to look forward to facsimile newspapers broadcast directly into the home, and perhaps even to some choice as to what part of the news one wants to have printed on his facsimile machine.

That stage of development should also make a difference in the kinds of news organizations that serve the home. For example, international newspapers could become a reality, and in very large countries national newspapers could circulate much more easily than now.

There might be a merger of some newspapers and broadcasting news units into a broader kind of news service, combining the sense of receiving "instant news" that television offers with the greater depth possible in print and facsimile

Much of the effect on news transmission may be felt even at the early stages when most satellite communication is point-to-point.

One of the characteristics of satellite communication is that the use of the space link should cost about the same regardless of the distance the message travels, providing that it is within the satellite's effective coverage area. This area can be as large as 40 per cent of the earth's surface.

This suggests the attractive idea that perhaps something like a flat rate (or an almost flat rate) for news, regardless of distance, might be established world wide thanks to the peculiar economic qualities of satellite transmission. If this were possible, it would help to even out the flow, and thus help to equalize the chance for one part of the world to know about others.

Similarly, satellites will sooner or later offer a chance to develop reliable teletype news service by radio to parts of the world where radio reception is not now reliable. They also offer an invitation to experiment with facsimile, a method which has been improved and used for the transmission of numerous kinds of pictural material, including newspaper pages for offset reproduction. Satellites extend these capabilities farther and invite the news media to review the question of what news functions might in the future be carried on by facsimile.

FOR television news, point-to-point satellites offer an opportunity to transmit news films and sound tracks more quickly and probably more cheaply. One major American network has announced that it plans to establish "self-contained news bureaux... complete with equipment and production crews for transmitting fully prepared stories" around the "main gateways for satellite communication"—meaning chiefly the country with ground stations.

The international news agencies and many national press associations are well aware of the potential of satellites for news transmissions, and ten of these organizations have formed a joint committee, with a secretariat, in London.

One of the keenest observers of the press has suggested that a joint advisory board should be formed, including the committee just mentioned, the International Telecommunications Union, the Communications Satellite Corporation, other organizations that may be responsible for launching communication satellites, and Unesco. This board, he suggests, should be responsible for examining all means by which the world flow of news could be improved through developments in space communication.

The contribution of Unesco to bringing satellites into use to assist the flow of world news might take the form of calling together such a group as this, representing as broad as possible a spectrum of news media, news agencies, and space communication, at first on a one-time basis, later on a continuing basis if that proved desirable.

It is reasonable to assume that most cultural exchange via satellites will be in the form of television, and that as long as we have only point-to-point satellites there will not be much of it. Most programmes, except spot news, sporting events of wide interest, or great historical events can be exchanged just as appropriately on films or videotape carried by jet aeroplane, as by satellite.

In fact many cultural programmes, such as opera, ballet and drama, are relatively timeless, and can be transmitted by almost any means. A complicating factor, however, is that if it proves impossible to negotiate for other than live transmission of certain art and entertainment events (for example some music festivals), an exchange by films or videotape might not be feasible.

Yet the televising of great events by satellite, the occasional live programme (for example, the "Our World" programme seen in Europe, North America, Mexico, Tunisia, Australia and Japan on June 25, 1967, and the sporadic "Town Meeting of the Air" programmes of discussion between Europe and America), along with the increasing amount of travel in the world, are building appetites for foreign television, and if satellite charges continue to decrease we may expect to see more foreign television via satellite.

There may be still more of it when distribution satellites come in, and offer the opportunity to use evening hours on an educational satellite for general programming. But the real impact of satellite culture exchange will come, if at all, when direct broadcasting satellites are operative.

We can only speculate now as to what these will do to television services. The opportunity will be there for international television, if the barriers and objections to it can be overcome. It is not beyond belief that, twenty years from now, television from several continents, along with a facsimile newspaper, might be readily available in any home where there is a receiver..

Satellite programmers will know less and less about their audiences and may be forced into more and more innocuous programming in order to meet a wide variety of tastes and avoid offending a wide variety of sensitivities.

Furthermore, satellite broadcasting over a very wide range is certain to come up against the problems of national sovereignty and national cultural sensitivity. What is a documentary to one country may be propaganda to another country. What is great literature to one country may be offensive to another. What is history to one country may be provocative to another.

Even what is education to one country may be contrary to the norms and beliefs of another. In any wide-area satellite broadcasting there is

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Photo USIS

FIRST OPEN-HEART OPERATION SEEN VIA SPACE

On a television screen in the University of Geneva (Switzerland), below, doctors and students follow stages of an open-heart operation being performed at the same moment by U.S. surgeons in a hospital at Houston (Texas) over 3,000 miles away. This first experiment in Mondovision was made possible in 1965 by "Early Bird", a satellite placed in orbit some 22,000 miles above the Atlantic. Above, television camera records surgical techniques for transmission by closed circuit to a medical congress.

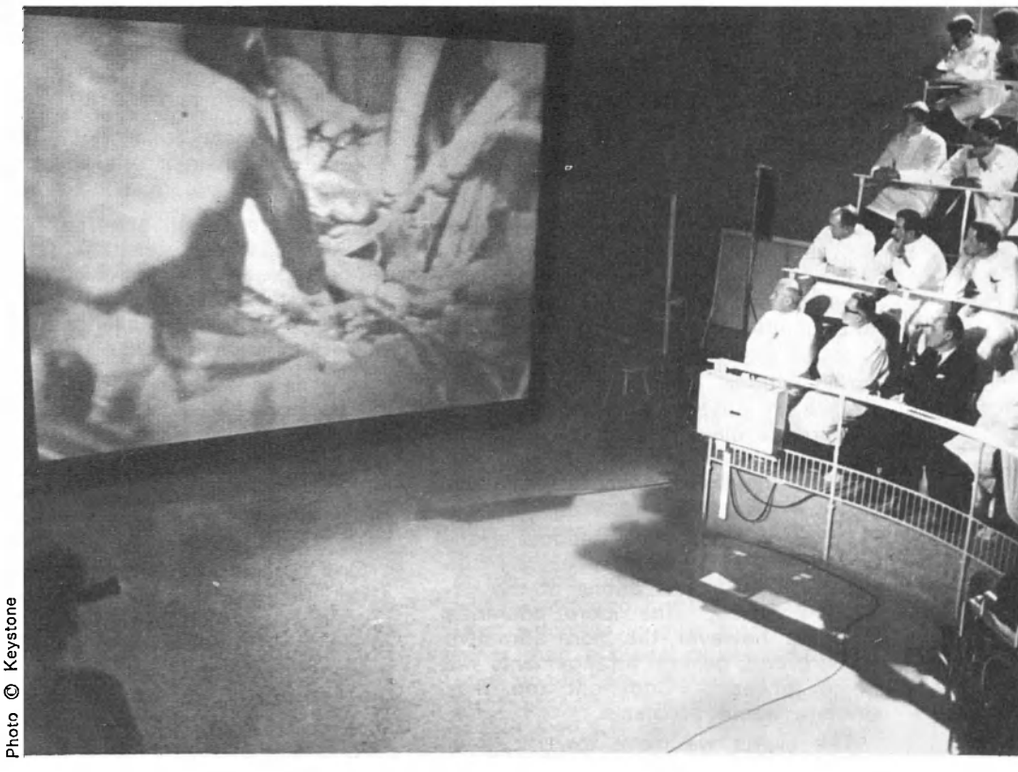

Photo © Keystone

Performer's rights in the era of satellites

likelihood of unintentional overlap of coverage areas, as well as opportunities for intentional propaganda to other countries.

Along with this, consider the peculiar vulnerability of a satellite to hostile action. It is relatively easy to jam the communication link to the instrument, and in some cases even to take it over at times for one's own messages. It is also within easy possibility to break the signal code by which the satellite is turned on or off, or by which the jets are operated to keep it in position.

Therefore, it is conceivable that a nation offended by a satellite's transmission might simply turn on the jets to move the satellite out of orbit and destroy it. It is clear that the world can hardly enter into this direct broadcast stage of cultural exchange until the institutions and patterns of co-operation, the mutually agreeable codes of programme conduct, and the arrangements for control of programme content and redress of grievances, are all carefully prepared.

Every public communication system requires controlling patterns and institutions so that its uses and content will be consonant with the norms of the society it serves. It is precisely because different nations of the world have different norms regarding freedom of information that satellite communication represents a difficult control problem.

THE more international communication the satellites carry, the more necessary it will become to surround the satellite system with a pattern of law and orderliness and some institutional arrangements to manage the control problems. If these arrangements are not in working order by the time we are ready to begin direct broadcasting from satellites, then we shall face a very dangerous situation.

Point-to-point communication by satellite is unlikely to challenge national sovereignty, and domestic legislation will provide recourse for individuals or organizations who consider themselves to be injured by satellite transmissions.

Some problems may arise from differing national legislation on libel and breach of privacy, and the rights of performers may have to be redefined or reconsidered on an international basis if their performances are made public in a number of distant countries.

At present these international arrangements are typically made by the broadcasting organizations of the nations involved. The more countries involved, however, the more attractive some broad, general arrangements will come to seem. Copyright, too, may present some problems.

The closer we move toward direct broadcasting, the more imperative it will become to approach on an international basis the problem of preventing abuses of the new capability for international communication. It is predictable that efforts to establish an international legal system for information will be resumed, at or near the point where they were carried by the 1948 Geneva Conference. Some institutional arrangements to carry out control agreements will doubtless be required.

Space law seems to be evolving within long-accepted outlines of international law. At the time of the International Geophysical Year, all nations agreed by common consent to an evolutionary step of such importance that it might be considered a part of the "common law of mankind": that outer space may be used for peaceful and scientific purposes without restrictions based on terrestrial sovereignty.

A second principle, the basic right of a nation to defend itself from attack, whether from the ground or from outer space, is embodied in Article 51 of the Charter of the United Nations. It points to the obvious need of defining what in the field of information constitutes an "attack", and providing controls and opportunity for redress.

A third principle is that of *orderliness* in space, illustrated by the international agreements already arrived at for use of the radio spectrum which, like space itself, is conceived as the common property of mankind. It is desirable now to devote major attention to defining these developing norms in practical terms.

But a professional code typically requires a professional body to administer it. A set of rules or regulations, or a body of law, is of little value without enforcement and administration. Therefore, it is necessary to consider the kinds of international institutions and arrangements that would be required to maintain a rule of law and order in space broadcasting.

The developing situation being what it is, this institution should be designed not only to administer an existing code, but also to meet a series of unforeseen problems and challenges as human experience in space unfolds.

How can we begin to move toward the goal of very wide exchange, even where the pattern does not now exist? The European Broadcasting Union has its own exchange organization, Eurovision, and the nations of East Europe have a parallel to it, Intervision.

One reason why the prospect of a distribution satellite is so attractive in Europe is that a firm basis already exists there for the exchange of programmes. There is also provision in the Far East. No such regional exchange organizations exist, however, in Africa or the Americas.

In this problem, as in others we have talked about, there is much to be done on the ground before we leap into space. Perhaps, the first step should be to encourage intercultural co-operation among broadcasters, as it has been encouraged in Europe, quite apart from any consideration of space links for this exchange.

AT the same time it would be useful to try to understand some of the problems involved in such co-operation, and how they may be overcome. Unesco has begun to collect some of the experiences of regional organizations with exchange of programmes. This is a sound and practical step and should furnish some guidance both for new regional organizations, and for co-operative efforts on a world-wide scale.

The Chairman of the Board of the National Broadcasting Company (United States) has advocated a world-wide association of broadcasters. Nothing less than that, he says, "can provide a wholly effective nerve centre to serve emerging needs rising from television's rapid global growth. These include the need, not only for a central file of programmes available for purchase or exchange, but for a clearing house to deal with such factors as time differentials, copyrights, union arrangements, scheduling clearances and simultaneous translation."

It is apparent that much international exchange of cultural programmes can and will take place without the use of satellites, and therefore if regional and then world-wide exchange can be facilited in general a certain part of the practice will merge into exchange by satellite.

This would then be a step toward meeting the problems of direct broadcasting by satellite. At least, the habit of co-operation would be set up, and various forms of it—for example, the joint planning and production of a programme—would be tried out. Such difficult problems as performer's rights and copyright would be aired.

Problems like these might be the

Just published

COMMUNICATION IN THE SPACE AGE
(the use of satellites by the mass media)
Unesco, 1968. Price $4.00; 20/-stg.

Based on a score of studies submitted by specialists in the development of space communication to a meeting convened by Unesco, in December 1965, to consider the use of communication satellites for education, science and culture.

As the Winter Olympic Games take place in Grenoble (France) from February 6 to 18, transmissions via communication satellites enable millions of televiewers as far away as Japan and the United States to watch the events Photo shows Olympic bobsleigh track illuminated for night race. Two satellites, "Early Bird" and "Lani Bird", are retransmitting 27 hours of sporting events during the Games. During the last Olympic Winter Games, held four years ago in Austria, each relay by "Telstar" satellite was limited to 11 minutes duration.

Photo Photopress, Grenoble

next areas where Unesco or other appropriate organizations could help pave the way toward direct broadcasting of cultural programmes by satellite. The question of copyright, as affected by satellite transmission, needs to be studied.

The Buenos Aires round table of 1964 on Legal Systems Governing Satellite Communications, as reported by Armando Cocca, concluded that an extension of the present copyright convention would provide adequate protection.

The rights of performers will present more complex and difficult problems in the satellite age, and the Berne Convention, as revised at Rome in 1961 and at Stockholm in 1967, clearly needs re-examination. When it is decided what modifications, extensions, or replacements of these agreements are desirable, then new instruments, if needed, might be drafted by the appropriate parties and brought to the attention of governments.

Studies and possible agreements of these kinds would be easier than the ultimate problems of control and organization which must be met before direct broadcasting becomes a reality. Yet at the appropriate time these too can be faced. Whether the problem of freedom and control, as applied to space broadcasting, is taken up as an extension of the 1948 United Nations sessions, or otherwise, it would be desirable to stimulate preparatory dialogue.

Practising broadcasters and international legal scholars believe that a high degree of co-operation, tolerance and restraint, along with suitable agreements and administrative machinery, will be required if direct broadcasting from satellites is ever to be anything other than a piece of science fiction or a non-fictional fiasco. The reason for approaching these problems today is that they will certainly be far worse tomorrow.

A prize-winning essay from Uruguay

THE WORLD WE HOPE FOR

by Maria Cristina Costa Diaz

BY "The world we hope for" I mean the world hoped for not only by the present generation to which I belong, but by future generations. Aspirations to a better world cannot be fulfilled in a single life-span, which is but a moment in the immensity of time.

The world we hope for, then, should bring:

Lasting peace: no more wars between nations or groups of nations; no expansionist countries using their superior material, military or economic strength to abuse or violate the rights of weaker countries; an end to the causes of strife within nations; no endless class struggles; international relations governed by clear, just principles which always respect the people's rights; a lasting peace, free from fear and oppression.

Concord and solidarity among all men: no infuriating disparity between those who make millions and those who have not even enough to feed their families properly. The sight for ever banished of the destitute begging for charity in the streets, when what they need, as our equals in rights, is work, a chance to improve their lot and to restore their confidence and faith in themselves. To be spared the sight of ragged children selling band-aids, tranquilizers and matches in public buses, when their parents should be the ones to work; and to be rid of the selfish and miserly whose very existence means that many of their fellow-beings go hungry. The benefits would be universal if men acted upon feelings of friendship and mutual respect, instead of merely paying lip-service to them!

The spread of education and knowledge throughout every continent so that the light of learning may disperse the shadows of illiteracy. Education made available to all—an education no longer theoretical and largely divorced from life; all the cultural resources of society at the service of of the whole community.

The aim of teaching and education to be a training for life, providing instruction rooted in life itself and in the fundamental problems of the day. To this end, industrial and agricultural education should be developed and intensified, as should scientific and technological research. In other words, the aim should not be to make (or rather deform) to measure persons whose professional skills serve merely to plead the cause of privilege and to uphold the privileged; on the contrary, professional training should be dedicated to the service of society as a whole.

The printed word is the most powerful instrument of man's development: it satisfies the infinite thirst for knowledge and is unmatched as a medium of intellectual communication; it maintains the continuity of history and culture, the common heritage, animating force and living essence of a people, which it behoves us all, as cells of the social organism, to conserve, defend and cherish. Books train and cultivate the mind. All men must be educated and taught their civic rights and duties so as to enjoy a real freedom of decision, without the risk of being cheated or defrauded in their aspirations.

Study as a corner-stone of life, so that when literacy becomes universal, everyone may find opportunities of applying, in their community and especially in their work, all they have learned.

The promotion of science and technology, symbolic of the present and the future, to enable man to explore infinite space, and allow human intelligence to penetrate far and deep in its insatiable thirst for knowledge.

The Uruguayan scientist, Clemente Estable, addressing the Uruguayan Chamber of Representatives, which held a session in his honour on October 3, 1960, declared : "In our time, when even astronomy has become, amazingly, an experimental science, with artificial satellites and planetoids, scientific research is an absolute and imperative necessity, and any investment in such research is of great significance for democracy."

The paths of science and technology lead to the realm of energy, light and speed. A stimulus must be given to all speculative pure or applied thought (in philosophy or the sciences) and to every concrete expression of the concept of beauty (in the realm of the arts, whether sculpture or painting, music or literature.) The essential aim is to enhance the meaning of life through art, and thus hallow the triumph of spiritual over material things.

Increased production, and the abundance that will result from compulsory work, whose effects will be chiefly felt in the productive sectors; by planning and rationalization of production; by the contribution of technology; by economic development. All this should make for abundance; enough food for all, an end to malnutrition; lower death rates; prevention and eradication of sickness; the guarantee of a better life for future generations; a fair distribution of the national income.

The concept of work as a law of life, in accordance with the following principles: compulsion to work for all the mentally and physically fit; a normal work day to satisfy not only the needs but the reasonable and legitimate desires of all; elimination of social parasites so that each can and must live by his own resources, not by the effort and sacrifice of others.

Freedom from crime. The minds of men purged of criminal thoughts by vigorous campaigns of education

A regular programme on Uruguayan television, "The Questions of Man", is entirely devoted to themes from the "Unesco Courier". Last year, the programme's director, Señor Eduardo Adrian, and the Losada Publishing House in Montevideo organized a nation-wide essay contest for Uruguay's high school students on "The World We Hope For". We are pleased to publish here the text of the winning composition written by 16-year-old María Cristina Costa Díaz, a student of the Sacred Heart Institute, in Montevideo, whose prize was a collection of 30 books and a three-year subscription to the "Unesco Courier". Photo shows Señorita Costa Díaz with (on her left) Salvador Valle (second prize), and Juan Carlos Mondragón (third prize).

and re-education from the social, psychological, moral, individual and professional viewpoints. Creation of economic and social conditions which will do away with the socio-economic roots of crime. Penal laws with humane and social aims that concord with the most progressive recommendations adopted by specialists at international congresses, always bearing in mind that a prison should not be a place of torment and retribution, but of re-education, rehabilitation and work. And measures should be taken to prevent criminals from buying immunity from the law through influence.

Proper housing for all. The "right to a roof" is a primary, elementary and essentiel right which must be guaranteed by the State. It is one way of giving self-respect to the citizen and promoting a better standard of living.

An end to man's exploitation by man, that appalling evil which still persists in various hidden forms: all men to be of equal standing, with neither exploiters nor exploited; work as a social force used to further the general interest, creating wealth for all; the fashioning of a new mentality, taking for granted that man should be the brother and friend of man, not his plunderer, and that everyone should support and help his neighbour.

Strong feelings of solidarity, deadened under the present competitive system, would be aroused, and "all for each and each for all" would acquire real meaning as a principle of work, with a full, human, fraternal relationship uniting all mankind as artisans of progress.

Full development of "fundamental rights". I will refer to only one of these: freedom. This implies, in institutional and material terms, the right of everyone to fulfil a vocation and to develop his personality; and in the expression and communication of ideas, the right to meet together and to form associations, freedom to express political, philosophical, moral and religious ideas of any kind and the right to exercise any profession or occupation, as well as to develop any manual, scientific or cultural skill.

Freedom of work, certainly, but also for everyone the right to work, to do an honest job without being exploited; and for the State, the duty to provide it. In short, freedom unimpeded by economic, social or political barriers.

Ethical principles put into practice, shaping man's thoughts and acts. Fulfilment of moral precepts established by general consensus; man's thinking and actions guided by pure and worthy motives.

Justice for all, giving to each according to his needs, encouraging each to give according to his abilities, wiping out oppression and the existence of privileged groups which place themselves above the law.

Achievement of real equality, as all will have the same rights and duties, and the same economic, social, political, cultural and vocational opportunities.

The reign of truth and sincerity with men speaking from the heart, in purity of intent and action, and an end to lying, hypocrisy and dissimulation.

Governments worthy of civically mature peoples: upright, loyal, honest defenders of the general interest; neither corrupt nor corrupting, nor venal; neither enriching themselves in office, nor betraying the people. Politics practised with a moral sense of civil guidance and conduct, without suborning or purchasing the conscience of men with money or favours; in other words, politics based on maturity and enlightenment, instead of ignorance.

The disappearance of existing colonies and the incorporation of their peoples in the concert of free nations. In our century of satellites and space rockets, in this atomic and thermonuclear age, colonies are a blot to be wiped from the face of the planet once and for all. We Uruguayans finally threw off all foreign yokes in 1828. Shame on the human race that colonies should still exist in our world today.

The world we Uruguayans hope for fits into the pattern already outlined (conceived not as a vision of tomorrow but of a future time), yet has some special features of its own.

In the reality we expect for Uruguay and the other Latin American countries, the following aims should be achieved: land must be put to better use, redistributed to serve the whole community, exploited rationally and with the help of modern technology; sources of employment must be created, as the only effective weapon to attack enforced idleness; commerce and industry must be planned to take account of national needs; the various branches of national legislation must be renovated and adjusted to current ways of life and to the pace and demands of our time.

Education and instruction must be available to all, with priority for those living in the countryside; a vast literacy campaign should be promoted, and school-building accelerated. Higher agricultural, industrial and technical education must also be developed.

All public services must be reorganized, to prevent the irrational distribution of specialists, technicians, office staff and manual workers. Their knowledge and ability should be used to the best advantage, with agricultural engineers and specialists working in rural agricultural schools, not in offices in the capital; and in general, all professional men, doctors, lawyers, architects and others should devote their efforts to the work for which they were trained.

HOMES ON STILTS are those of fishermen who live in parts of the Great Lake of the Tonle Sap where the least annual flooding occurs. The projected Tonle Sap barrage will control the maximum water level of the lake and increase its depth in dry weather, thereby regulating fish production which today fluctuates according to the extent and duration of floods.

Photo © Raymond Cauchetier

Unesco mathematical model to harness the Mekong *(Continued from page 22)*

ments and a certain co-operation on the part of nature.

With this special Model hydraulic and hydrological conditions in the Delta, from Chlong to the South China Sea and the Gulf of Thailand were simulated, first without and later with a dam: the data collected in the field and those already available were subjected to computer analysis taking the two sets of conditions, without and with the dam All these materials will be carefully kept because, with modifications appropriate to different conditions, they can be used in future investigations, perhaps for the study of different problems.

At the SOGREAH laboratories, where the computer work was done, six specialists—two from Cambodia and four from the Republic of Viet-Nam—were given UNDP fellowships to be trained in the use of the Model. Though unexpected vagaries of the monsoon caused delays in the measurement campaign, the first three phases of the project were almost finished by the end of 1965. With all the essential data collected at this time, it was thus possible to complete the final model by early 1966.

Coming to the end of this programme after seven years, and with a joint expenditure of slightly more than $1,250,000 by the governments concerned and UNDP, it is logical to ask: has the project been successful and has it been worth while?

The completed project demonstrates a number of special achievements.

In the final plan the Mathematical Model has enabled the technicians to find answers to many questions relating to the effect of the Tonle Sap dam. It can now be demonstrated that the control of the flood-water will be effective, although less so than was expected, but that great care will be needed to avoid aggravating the flood effect, mainly in Cambodia.

Taking the results of the programme as a whole mention can be made of three notable conclusions:

- There is now agreement between the specialists on what could be expected of the Tonle Sap dam;
- The Mathematical Model is an essential tool for effecting the best control of the flood. It may also be used for studies yet to be made on possible dam sites in the upper part of the Mekong Basin and may permit the study of the effects on the Delta of upper basin regulation;
- In order to adjust the model, a survey has been carried out which has added to the knowledge of the Delta. For example, the curve defining the capacity of the lake as a function of the water level is now accurately known.

In the broader sense, the carrying through of this project has contributed new scientific techniques which can and will be used in other parts of the world.

The project has also an important educational factor in that competent senior personnel from countries of the region have received high level training in specialized laboratories in fields such as programming, hydraulics, computer mathematics, engineering technology and administration.

Finally some comment is due on the spirit of international technical co-operation which prevailed throughout the project.

In an area where there were periods of major political conflicts and strained diplomatic relations, at no time was it necessary to suspend or interrupt the work of the committee. This fact alone has instilled into the project a healthy air of confidence which it is hoped will carry on into the development projects that the creation of the Mathematical Model has made possible.

Letters to the Editor

FARADAY AND THE DYNAMO

Sir,

In "Great Men, Great Events" (Oct. 1967) I read that Michael Faraday invented the dynamo. I believe this is incorrect. The dynamo—the machine capable of generating a continuous electric current—was invented by a Belgian, Zénobe Gramme, a contemporary of Faraday. I believe Faraday, in his experiments, concentrated on alternating current. The first successful generation of continuous current cannot be attributed to him, but this in no way detracts from his talents.

Raymond Bertrand
Brussels, Belgium

Dr. B. N. GOSWAMY
A CORRECTION

Sir,

My contribution to the studies of Indian and Asian art is far more modest than is suggested by the biographical note on me which appears in the Dec. 1967 issue of the "Unesco Courier", accompanying my article on "The Epics in the Art of India and South Asia". The error in my identification appears to have arisen from my surname which I share with other and learned authors. The principal field of my work is the History of Indian Painting and my publications do not include the titles listed in the biographical note.

Dr. B. N. Goswamy
Professor of Art History
Panjab University
Chandigarh, India

THE RIGHT VALUES
FOR CULTURAL TOURISM

Sir,

What is Unesco doing for the preservation of cultural assets not carved in stone? Your reports on plans for "cultural tourism" in Turkey, Peru and Iran (Dec. 1966) qualifies as "tourist attractions" such things as "native traditions, customs, national dress, folklore, etc."

As a student of folk music, I submit with all respect that if large-scale tourism is brought to Peru, the young Peruvian piper whose photo you reproduce will in a few years be a thing of the past. This young man will be driving a taxi or slouching around in the streets of the neighbouring town. The "attractions" you mention will be nothing more than artificial survivals for exhibition at annual fairs.

Should not economic development take more responsible forms? Should it not, among other things, encourage the native crafts instead of meddlesome activities from outside the country? Efforts of that kind should at least go side by side with the plans in view, if we are to avoid a social convulsion, the effects of which are hard to foretell. Unesco should be concerned primarily with these matters And this, I may presume, is your general practice, although these articles harp rather too much on the scramble for foreign exchange.

The attentive reader might question your optimism about international understanding ·International understanding is nothing more than "education" and, in this context, the education of both parties. The mass tourist, however, does not travel in search of culture, but, for the most part unprepared and without any inward urge, wants to spend his holiday in an "interesting" place. The inhabitant of the country visited is thinking solely in terms of "money". The result, I am afraid, is what ethnologists would call an "exchange between mutes". (Sausages, films, picture postcards and straw hats can be sold just as easily by slot machines; and, all the world over, the tourist guide is, regrettably, little more than a superior gramophone.) What has so far been achieved in this branch of work and what, to judge by your articles, is still to be achieved is not the beginning of understanding, but its lamentable end!

That, of course, is no more your fault than mine; yet I consider that it should be your job, in future undertakings of this kind, to set the right standards

If I may be allowed the question, what will become of the "investments" spoken of, should the flow of tourists not materialize or gradually dry up? True, a restored temple will retain its incalculable value (scientific or other), but a change in a country's infrastructure, brought about artificially from beyond its borders, is left behind, stripped of all meaning. It can only be hoped that the authorities on both sides are not thinking *exclusively* of foreign currency, for what ends have hitherto been served by the blessings of foreign exchange and teeming tourists? Nowhere have they contributed anything worth mentioning to *native* studies or to any notable flowering of an indigenous culture. All that they have done is to hasten its decay or, at best, to sap its vitality in every sphere.

In conclusion, may I thank you for your informative magazine and assure you that I follow your projects with lively interest.

Leonard Vohs
Cologne, Fed. Rep. of Germany

UNITED STATES OF EUROPE ?

Sir,

Congratulations on your issue "U.S.S R. Today" (November 1967) I wonder whether you could publish a similar issue on the United States, dealing with roughly the same subjects in equal depth and breadth.

May I also suggest an issue on "The United States of Europe: Myth or Future Reality", which could include articles on Christendom in the Middle Ages; the ideas of France's Henry IV; the Europe of the Emperor Charles V, of Louis XIV, the "Sun King", of Napoleon and of Hitler; and the ambitions of each of these men; also the efforts being made today in the context of the European Economic Community.

I should also welcome an article comparing the U.S.S.R. and the United States from an administrative as well as an economic viewpoint: how, for example, the American states and the Soviet republics administer their own affairs and to what extent they are obliged to comply with federal laws.

Jean Catherineau
Bordeaux, France

WORLD PETITION
FOR PEACE

Sir,

In your issue on "War or Peace" (August-September 1967) I was struck by the identity of views expressed by men of such different outlooks as Pope Paul VI, a Soviet journalist and Philip Noel-Baker—namely that war is anachronistic and absurd and that all "men of good will" must devote themselves urgently to building a lasting Peace. I believe public opinion will be awakened to the terrifying prospect of a nuclear war, a danger which we must strive to eliminate. The solutions you propose are reasonable, realistic and sound. A call for a world petition is not a Utopian idea—it would certainly disclose the profound longing for peace felt by millions of human beings.

Elisabeth Coin, aged 16
Caen, France

COSTA RICA SETS
AN EXAMPLE

Sir,

As a mathematics teacher in the oldest high school in Costa Rica and an admirer of your magazine, I decided in December 1966 to take out ten one-year subscriptions with money collected by my 100 students. When the next academic year began the following March we already had in hand 30 copies of the magazine with which to establish a circulating library. By the end of the year each student had been able to borrow five different issues, each for a two-week period, and was then presented with a copy to keep. Among your 1967 issues "Africa and the African Genius", with its excellent map, "Expo 67" and "The Population Crunch were favourites with these young readers.

I think such a scheme could be followed in hundreds of secondary schools, thus promoting the diffusion of your splendid magazine.

Rafael Llubere Zúñiga
San José, Costa Rica

From the Unesco Newsroom...

Australia's weather data satellite

Australia has become the seventh nation to place an artificial satellite in orbit around the earth. Named Wresat, the Australian-built satellite was launched on November 29, 1967 from the Woomera Rocket Range with a U S rocket and with the help of British technical facilities. Conical in shape and weighing 100 lbs (45 Kg), its primary object is to transmit scientific data for studies of climate Other nations which have successfully launched artificial satellites are Canada, France, Italy, U S S R, U K. and U.S A.

Cyclone warning system for Pakistan

The Swedish Save the Children Organization has given a modern hurricane warning system costing about $200,000 to Pakistan. Functioning by radar, the system can detect hurricanes 250 miles away It will protect a region in East Pakistan where hurricanes occur frequently, causing many deaths each year.

Medicated salt against malaria

By impregnating ordinary cooking salt with chloroquine, an anti-malarial drug, the World Health Organization may have found an effective way to combat malaria among nomadic peoples In a pilot project in Iran, the malaria parasite rate among nomads using the medicated salt dropped in one year from 18.7 per cent to 3 4 per cent, and to 0 11 per cent in the following year. Malaria control among nomads is difficult because their way of life makes spraying of living quarters impractical and regular drug-taking difficult

Lifting taxes on knowledge

Representatives of 68 governments, meeting in Geneva under Unesco's auspices, have recommended the elimination of tariffs and frontier formalities affecting the international circulation of audio-visual equipment, books, newspapers, magazines, works of art, scientific apparatus and articles for the blind Two Unesco international agreements aimed at easing the circulation of educational, scientific and cultural materials already exist; the Geneva meeting urged that they be given wider application; in particular, that sound recordings for broadcasting and apparatus for fundamental scientific research be duty-free

REGULAR PAGES IN FULL COLOUR

We wish to remind our readers that, as in past years, the UNESCO COURIER will publish 20 full colour pages grouped in four of five issues during 1968.

Motorists, T.V. is watching you

Television cameras placed at busy intersections may give United States road safety experts a better idea of what actually happens in traffic accidents. To be used initially on an experimental basis, the cameras will monitor traffic continuously, erasing the video record automatically every twenty seconds. However, the sound of an accident will touch off a signal and preserve the preceding images. The United States Department of Transportation is installing the first monitoring unit in Buffalo, New York State, and plans to set up 75 to 100 others if the experiment is successful.

Cheaper drilling for minerals

Scientists in Australia are experimenting with high-pressure water jets as a means of drilling holes for mineral prospection. In laboratory tests with the new method hard granite has been cut at a rate of about one foot (30 cm) a second over a short period, much faster than conventional diamond-tipped drills Subjected first to very high pressure, the water is released through a fine nozzle, reaching a velocity of 2,000 feet (600 metres) a second. If commercially applicable, this drilling technique would be not only faster but also cheaper than diamond drilling, which can cost $20 a foot ($66 a metre).

6,000 U.N. specialists aid developing countries

During 1967-68 more than 6,000 specialists are participating in technical assistance projects in 113 countries under the United Nations Development Programme (UNDP) These projects are carried out with the help of U.N. specialized agencies Their cost during the two-year period will total $140 million, of which $114 million will be spent in Africa, Asia and Latin America.

Flashes...

■ *Spain has singled out 1,550 of its historic buildings and sites for State conservation and restoration*

■ *In Brisbane (Australia) technicians have perfected a typewriter which flashes the words typed onto a screen, thus enabling dumb persons to communicate rapidly with each other*

■ *Young men drivers with good academic records in school or university have fewer accidents than those with poor records, a United States insurance company has found.*

■ *The first Soviet observatory specially designed to study comets is being built near Kiev.*

■ *There are now more than 191 million motor vehicles in use in the world, compared with only 56 million in 1946.*

■ *An underground concert auditorium is being built in the Jeita Cave near Beirut, Lebanon—the largest known cave in Asia.*

BOOKSHELF

U.N. BOOKS

■ **International Space Bibliography** 1966 ($4.00).

■ **Economic Survey of Latin America, 1965** 1967 ($5.00).

■ **The Libraries of the United Nations** (A descriptive guide) 1966 ($1.50).

U.N. publications can be ordered through bookstores, through the Unesco Publications Center, New York (see page 35) or from U.N. Sales Section New York and Geneva.

MENTOR-UNESCO ART BOOKS
FONTANA UNESCO ART BOOKS

■ **The Art of Central Africa: sculpture and tribal masks**
Introduction by William Fagg.

■ **Renoir**
Introduction by Michel Drucker.

■ **Miro**
Introduction by Jacques Dupin.

Mentor-Unesco Art Books are published by The New American Library, New York and Toronto, by arrangement with Unesco, 1967 ($1.25).

Fontana Unesco Art Books are published by Collins, London, in association with Unesco, 1967 (5/-).

HISTORY AND HISTORY TEACHING

■ **The Middle Age of African History**
Edited by Roland Oliver.
Oxford University Press, London, 1967 (13/6).

■ **A Handbook for History Teachers**
By R. Vajreswari
Allied Publishers Private Ltd. Calcutta, 1966 (Rs. 14.00).

■ **South-East Asia in World History**
(A course for lower secondary schools)
3: The Modern World (2nd ed.)
By P.B. Hilton and D.J. Tate
Oxford University Press, 1967 (13/-).

★

■ **The Story of the English Language**
By Mario Pei
A revised edition of "The Story of English"
J. P. Lippincott Company, Philadelphia and New York, 1967 ($6.95).

■ **The Electronic Revolution**
By S. Handel
A Pelican original, Penguin Books, Harmondsworth, England, 1967 (6/-).

■ **The Novelists' Inheritance in French Africa**
Writers from Senegal to Cameroon
By A. C. Brench
(Three Crowns Library)
Oxford University Press, London, 1967, (10/6).

■ **British Further Education**
By A.J. Peters.
Pergamon Press, Oxford, 1967 (63/-stg.).

■ **World Peace Through World Law (Two Alternative Plans)**
By Grenville Clark and Louis B. Sohn
Harvard University Press, Cambridge, Massachusetts, 3rd ed. enlarged, 1966 ($5.25).

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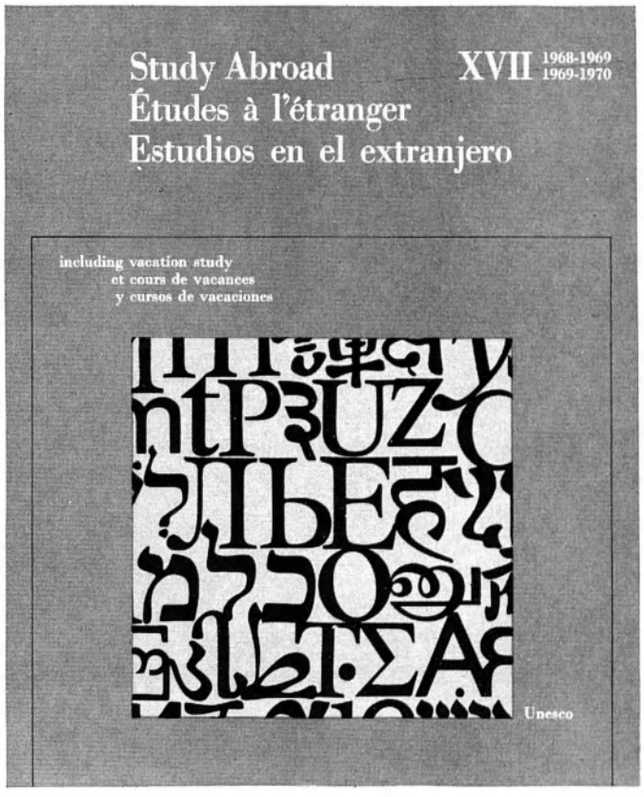

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Photo © Raymond Cauchetier

ELECTRONIC COMPUTER HELPS HARNESS THE MEKONG

Until recently man had never attempted to control the unpredictable Mekong ("Mother of Rivers"), one of the world's longest rivers (2,600 miles) whose vagaries directly affect the economy of vast areas of South-East Asia. The development of the Lower Mekong Basin concerns Cambodia, Laos, Thailand and the Republic of Viet-Nam, but cannot be carried out without international assistance. For the past seven years Unesco and the United Nations Development Programme have worked with these countries on plans to control the lower course of the Mekong. For this unprecedented project a mathematical model of the Mekong Delta has been created with the aid of an electronic computer (see article page 17).